

# Drinking Water Source Assessment and Protection (DWSAP) Program

AUGUST 1998 FINAL REVIEW DRAFT

[NOTE: Comments on this draft should be provided to the Department of Health Services (DHS) no later than September 30, 1998. See Section 1.2 (page 6) for DHS contacts to whom comments should be submitted.]

Division of Drinking Water and Environmental Management

California Department of Health Services

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **Table of Contents**

Table of Contents  
List of Tables  
List of Figures  
List of Appendices  
Glossary of Terms  
Acronyms

### **Part One: Introduction**

- 1.0 Introduction
  - 1.1 Description of the DWSAP Program Document
    - 1.1.1 Assessments
    - 1.1.2 Protection
    - 1.1.3 Implementation of Assessment and Protection Programs
  - 1.2 State Contacts
- 2.0 DWSAP Program Background, Goals, and Schedule
  - 2.1 Background
    - 2.1.1 Requirement and Authority for DWSAP Program Development
    - 2.1.2 Existing Drinking Water Source Protection Programs
    - 2.1.3 Drinking Water-Related Efforts in California
  - 2.2 Goals of the DWSAP Program
  - 2.3 Statutory Schedule and Timeline
- 3.0. Minimum Requirements for Drinking Water Source Assessments
  - 3.1 Surface Water Source of Drinking Water
  - 3.2 Ground Water Source of Drinking Water

### **Part Two: Development of California's DWSAP Program**

- 4.0 Public Participation in the DWSAP Program
  - 4.1 Stakeholders in the Process
  - 4.2 Technical and Policy Advisory Committees
  - 4.3 Mailing List of Interested Parties
  - 4.4 Development and Availability of Draft DWSAP Program Documents for Comment
  - 4.5 Public Outreach
  - 4.6 Revisions of the DWSAP Program Document
  - 4.7 Public Comment Period

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**5.0 Roles and Responsibilities of Government Agencies**

**5.1 Local Agencies**

**5.1.1 Counties and Cities**

**5.1.2 Special Districts**

**5.2 State Agencies**

**5.3 Federal Agencies**

**Part Three: Source Water Assessments**

**6.0 Delineation of Protection Areas and Zones**

**6.1 Delineation for Surface Water Sources**

Ground water under the influence of surface water

**6.2 Delineation for Ground Water Sources**

**6.2.1 Types of Aquifers**

**6.2.2 Recharge Areas**

Porous Media Aquifers

Fractured Rock Aquifers

**6.2.3 Delineation Methods for Ground Water Zones**

Ground Water under the Influence of Surface Water

Arbitrary Fixed Radius

Calculated Fixed Radius

Modified Calculated Fixed Radius Method

Analytical Methods

Detailed Hydrogeologic Mapping

Numeric Flow/Transport Models

**6.2.4 Selecting a Ground Water Delineation Method**

Porous Media Aquifers

Fractured Rock Aquifers

**6.2.5 Approach for Defining Ground Water Zones**

Well Site Control Zone

Zone A – Microbial/Direct Chemical Contamination Zone

Zones B5 and B10 – Chemical Contamination Zones

Buffer Zone – Additional Zone, If Needed

**6.2.6 Modification of the Shape and Size of Zones**

**6.3 Assessment Map**

**6.4 Boundary Drinking Water Sources**

**6.5 Tribal Drinking Water Sources**

**6.6 Transmission Facilities from Drinking Water Intake to Treatment Plant**



*California Drinking Water Source Assessment and Protection Program*

- 7.0 Inventory of Possible Contaminating Activities (PCAs) within Protection Areas and Zones
  - 7.1 Information for PCA Inventories
  - 7.2 Steps in developing an inventory of PCAs
    - 7.2.1 Develop an initial list of PCAs of concern that may exist within or near the protection area
    - 7.2.2 Prepare a PCA inventory form
    - 7.2.3 Conduct the PCA inventory within the delineated protection area
    - 7.2.4 Indicate PCA locations on the assessment map
  - 7.3 Names and addresses associated with PCAs
- 8.0 Vulnerability of Drinking Water Sources to Contamination
  - 8.1 Definition
  - 8.2 Vulnerability Analysis Procedures
    - 8.2.1 Drinking Water Source and Site Characterization
      - 8.2.1.1 Drinking Water Source Information
      - 8.2.1.2 Determination of Physical Barrier Effectiveness
        - Surface Water
        - Ground Water
    - 8.2.2 Modifying the Risk Ranking for a PCA
    - 8.2.3 Determination of Vulnerability
  - 8.3 Uses of Vulnerability Analyses
  - 8.4 Vulnerability Assessment Procedures in California Drinking Water Regulations
- 9.0 Implementation of the Drinking Water Source Assessment Program
  - 9.1 Source Location
  - 9.2 Protection Area and Zone Delineation
  - 9.3 Inventory of PCAs and Vulnerability Analyses
  - 9.4 Availability of Assessment Results
  - 9.5 Updating Information
  - 9.6 Anticipated Schedule for Drinking Water Source Assessments
  - 9.7 Assessments Done Voluntarily by Drinking Water Systems
- 10.0 New Drinking Water Sources

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Part Four: Voluntary Drinking Water Source Protection Programs**

- 11.0 Implementation of a Voluntary Source Water Protection Program
  - 11.1 Public Involvement during Development of a Source Water Protection Program
  - 11.2 Review Initial Drinking Water Source Assessment and Determine Whether Revisions Are Appropriate
  - 11.3 Initiate Protection Measures, If Appropriate
  - 11.4 Provide Information to the Public
  - 11.5 Drinking Water Source Assessment and Protection Information Updates
- 12.0 Management Approaches within Source Water Protection Areas
  - 12.1 State Programs Related to Source Water Protection
  - 12.2 Recommended Guidelines for Management in Protection Areas
    - 12.2.1 Surface Water Sources
    - 12.2.2 Ground Water Sources
      - 12.2.2.1 Recharge Areas
      - 12.2.2.2 Zones
  - 12.3 Local Management Actions
- 13.0 Contingency Planning for Drinking Water Supplies
  - 13.1 Contingency Planning at the State Level
  - 13.2 Minimum Components of Local Contingency Plans
    - 13.2.1 Assessment of the Ability of the Water System to Function with the Loss of the Largest Source of Supply
    - 13.2.2 Development of a Plan for Alternate Water Supplies
    - 13.2.3 Development of a Spill/Incident Response Plan

References

Appendices

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**List of Tables**

Table 4-1	Potential Stakeholders
Table 4-2	Technical Advisory Committee
Table 5-1	Matrix of Governmental Agency Roles and Responsibilities
Table 6-1	Indicators of presence and degree of confinement of aquifers
Table 6-2	Delineation methods, types of system that may use particular methods, minimum data that are required, and the minimum radii of zones
Table 7-1	California Drinking Water Primary and Secondary Maximum Contaminant Levels, Action Levels, and Unregulated Chemicals Requiring Monitoring
Table 7-2	Potential Sources of Surface and Ground Water Contaminants
Table 7-3:	Activities Associated with Very High Potential Risks
Table 7-4	Activities Associated with High Potential Risks
Table 7-5	Activities Associated with Moderate Potential Risks
Table 7-6	Activities Associated with Low Potential Risks
Table 9-1	Distribution of California's Drinking Water Sources by Public Water System Size and Source Type
Table 11-1	Potential Local Management Strategies for Source Water Protection Programs

**List of Figures**

Figure 6-1	Surface water supply protection areas showing proposed zones
Figure 6-2	Illustration of recharge areas
Figure 6-3	Changes to the ground water system due to a pumping well
Figure 6-4	Calculated fixed radius delineation method
Figure 6-5	Conceptual illustration of the calculated fixed radius method
Figure 6-6	Conceptual illustration of the modified calculated fixed radius method
Figure 6-7	Uniform flow equations for determining area of contribution to a pumping well
Figure 6-8	Delineation of a source water protection area by analytical methods
Figure 6-9	Conceptual example of protection area and zones in fractured bedrock
Figure 6-10	Illustration of conceptual ground water protection area and zones
Figure 6-11	Radius of microbiological Zone A (2-year time of travel), using calculated fixed radius method
Figure 6-12	Radius of microbiological Zone B5 (5-year time of travel), using calculated fixed radius method
Figure 6-13	Radius of microbiological Zone B10 (10-year time of travel), using calculated fixed radius method
Figure 7-1	Sample map showing ground water source, protection zones (concentric circles), and possible contaminating activities

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program***Appendices****APPENDICES TO BE USED FOR A SURFACE WATER SOURCE**

Appendix A—Location of Surface Water Source

Appendix B—Delineation of Surface Water Source Protection Areas and Zones

Appendix C—Physical Barrier Effectiveness Checklist - Surface Water Source

Appendix D—Possible Contaminating Activity (PCA) Inventory Forms and Checklists -  
Surface Water Source

Appendix E—PCA Evaluation Procedures - Surface Water Source

Appendix F—Vulnerability Analysis Procedures - Surface Water Source

Appendix G—Checklist for Drinking Water Source Assessment Report - Surface Water  
Source

**APPENDICES TO BE USED FOR A GROUND WATER SOURCE**

Appendix H—Location of Ground Water Source

Appendix I—Delineation of Ground Water Source Protection Areas and Zones

Appendix J—Physical Barrier Effectiveness Checklist - Ground Water Source

Appendix K—Possible Contaminating Activity (PCA) Inventory Forms and Checklists -  
Ground Water Source

Appendix L—PCA Evaluation Procedures - Ground Water Source

Appendix M—Vulnerability Analysis Procedures - Ground Water Source

Appendix N—Checklist for Drinking Water Source Assessment Report – Ground Water

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **Glossary of Terms**

**Abandoned Well:** A well (1) the use of which has been permanently discontinued, or (2) that is in such a state of disrepair that no water can be produced. Because abandonment is a state that also involves intent on the part of the well owner, a definition that prescribes a set of conditions and a time limit for use in applying standards appears in California Well Standards, California Department of Water Resources (DWR) Bulletin 74-90, Section and DWR Bulletin 74-81, Section 21.

**Assessment:** An evaluation of a drinking water source that includes delineation of the boundaries of the protection area of a drinking water source, identification of land uses and possible contaminating activities within that area, a determination of the vulnerability of the source to contamination, and release of information to the public.

**Assessment Map:** A required element of a complete source water assessment. An assessment map must be based on a USGS quadrangle map (scale 1:24,000). For surface water sources, an assessment map must indicate the boundaries of the watershed and any zones that are defined. For ground water sources, the assessment map must show the boundaries of zones and the approximate location of recharge areas. All assessment maps must show the approximate locations of possible contaminating activities (PCAs), in particular those with High Vulnerability (HV) or Moderate Vulnerability (MV) ratings.

**Community Water System:** A public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents.

**Drinking Water System:** See Public Water System.

**Improperly Destroyed Well:** An abandoned well that has not been destroyed in accordance with California Well Standards, DWR Bulletin 74-90, Section 23 and DWR Bulletin 74-81, Section 23.

**Noncommunity Water System:** A public water system that meets one of the following criteria: (1) Serves drinking water to at least 25 nonresident individuals daily at least 60 days of the year, but not more than 24 yearlong residents or (2) Serves 15 or more service connections and any number of nonresident individuals at least 60 days of the year, but no yearlong residents.

**Noncommunity, Nontransient Drinking Water System:** A noncommunity drinking water system that serves a predominantly stable population (e.g., a school or factory).

**Noncommunity, Transient Drinking Water System:** A noncommunity drinking water system that serves a predominantly changing population (e.g., a restaurant).

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Protection:** The process of managing the activities within a delineated protection area or zone to prevent drinking water source contamination.

**Physical Barrier Effectiveness:** A determination made about the ability of the drinking water source to be protected by its physical characteristics, including geology and hydrogeology, resulting from the drinking water source and site characteristics evaluation.

**Physical Barrier Effectiveness Evaluation:** An evaluation of a drinking water source that enables a determination to be made about the effectiveness of the natural geologic materials and/or hydraulic conditions in preventing the movement of contaminants to the drinking water source, which is a function of the intrinsic characteristics of the geologic materials that compose the land surface and subsurface. These characteristics are generally independent of land use, PCAs, or contaminant characteristics. This evaluation also includes considerations of well construction or surface water intake construction (design, condition, and structural integrity) associated with the drinking water source. This evaluation is an expression of "sensitivity," as the term is used in US EPA source water assessment and protection guidance.

**Possible Contaminating Activity (PCA):** Human activities or natural conditions that are actual or potential origin of significant contamination for a drinking water source. An evaluation of PCAs covers the drinking water source protection area and takes into account characteristics of the PCA and its related contaminants, including the characteristics of the potential origin of contamination (location, likelihood of release, compliance history of the facility, effectiveness of mitigation measures) and contaminant-specific information, such as toxicity and environmental fate and transport. PCAs include both microbiological and chemical contaminants that could have adverse effects upon human health.

**Protection Area:** The capture area for a drinking water source. For a surface water source, the protection area is the watershed. For a groundwater source, the protection area is the recharge area and the area within delineated control zones.

**Protection Zone:** Within a protection area of a drinking water source, a delineated area closer to the drinking water source or recharge area. Potential sources of significant contamination may require additional attention in assessments and protection activities when they occur in these zones.

**Public Water System (also Drinking Water System):** A system for the provision of piped water to the public for human consumption that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A public water system includes the following: (1) Any collection, treatment, storage, and distributions facilities under control of the operator of the system that are used primarily in connection with the system, (2) Any collection or pretreatment storage facilities not

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

under the control of the operator that are used primarily in connection with the system,  
(3) Any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

Sensitivity: See Physical Barrier Effectiveness Evaluation.

Service Connection: The point of connection between the customer's piping or ditch, and the water system's meter, service pipe, or ditch.

Significant Contamination: Contamination of source water by (1) chemicals for which maximum contaminant levels, or action levels exist, or which are identified as unregulated chemicals for which drinking water monitoring is required, at levels that would be detectable, or (2) by microorganisms known to pose health risks in drinking water, at levels that are likely to be detected or require treatment.

Source Water: Water drawn to supply drinking water from an aquifer by a well or from a surface water body (e.g., reservoir, lake, river) by an intake. Such water may or may not be treated before being distributed by a drinking water system for consumption.

Susceptibility: see Vulnerability.

Vulnerability: A determination of the greatest (most significant) threats to the quality of the water supply that takes into account the characteristics of the source and site to determine their effectiveness as a physical barrier to contamination. The vulnerability evaluation also considers the type and proximity to the water supply of activities that could release contaminants. Vulnerability, as defined in the DWSAP Program, is consistent with existing California regulations (see Section 8.5). Vulnerability also means "susceptibility," as the latter is used in US EPA source water assessment and protection parlance.

## Acronyms

ARB	Air Resources Board
AWWA	American Water Works Association
BMP	Best Management Practice
Cal/EPA	California Environmental Protection Agency
CDF	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Calculated Fixed Radius
CSFM	California State Fire Marshal
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendment
DDWEM	Division of Drinking Water and Environmental Management
DFA	Department of Food and Agriculture
DHS	Department of Health Services
DOC	Department of Conservation
DOGGR	Division of Oil, Gas, and Geothermal Resources
DPR	Department of Pesticide Regulation
DTSC	Department of Toxic Substances Control
DWFOB	Drinking Water Field Operations Branch
DWR	Department of Water Resources
DWTPB	Drinking Water Technical Program Branch
DWSAP	Drinking Water Source Assessment and Protection
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographical Information System
GPS	Global Positioning System
GWR	Ground Water Rule
HE	High Physical Barrier Effectiveness
HV	High Vulnerability
IWMB	Integrated Waste Management Board
LPA	Local Primacy Agency
LE	Low Physical Barrier Effectiveness
LV	Low Vulnerability
NPDES	National Pollutant Discharge Elimination System
ME	Moderate Physical Barrier Effectiveness
MV	Moderate Vulnerability
NPS	Nonpoint Source
NRCS	National Resources Conservation Service

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

OEHHA	Office of Environmental Health Hazard Assessment
PCA	Possible Contaminating Activity
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SDWA	Safe Drinking Water Act
SWAP	Source Water Assessment Program
SWP	Source Water Protection
SWRCB	State Water Resource Control Board
USDA	US Department of Agriculture
USGS	US Geological Survey
US EPA	U.S. Environmental Protection Agency
WHPP	Well Head Protection Program
ZOC	Zone of Contribution

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## PART ONE

### Introduction

An introduction to the California Drinking Water Source Assessment and Protection Program document, and a summary of the minimum requirements for an assessment

Section 1—California's process of developing the DWSAP Program and information on State contacts

Section 2—The DWSAP Program's background, goals and schedule

Section 3—The minimum requirements for a drinking water source assessment under the DWSAP Program

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 0 1 6

## 1.0 Introduction

This document presents California's Drinking Water Source Assessment and Protection (DWSAP) Program. The Department of Health Services' (DHS') Division of Drinking Water and Environmental Management is the lead agency for development of the DWSAP Program and its implementation.

The DWSAP Program has been prepared in response to the 1996 reauthorization of the federal Safe Drinking Water Act (SDWA), which included an amendment requiring states to develop a program to assess sources of drinking water and encouraging states to establish protection programs. A drinking water source water protection program envisions a partnership between local, state, and federal agencies to ensure that the quality of drinking water sources is maintained and protected.

The drinking water source assessment is the first step in the development of a complete drinking water source protection program. The assessment requires delineation the area around a drinking water source through which contaminants might move and reach that drinking water supply. In addition, it requires an inventory of activities that might lead to the release of microbiological or chemical contaminants within the delineated area. This enables a determination to be made as to whether the drinking water source might be vulnerable to contamination.

California's DWSAP Program will address both ground water and surface water sources, drawing upon US Environmental Protection Agency (EPA) guidance, DHS' experiences from other related programs, and advice from advisory committees and the public. The EPA has indicated in its drinking water source assessment guidance (US EPA, 1997) that delineation and contaminant inventory elements for ground water sources are to be consistent with wellhead protection program approaches. Since California has not developed a wellhead protection program, the ground water portion of the DWSAP will serve as the State's wellhead protection program. For surface water sources, DHS' experience with other activities, such as watershed sanitary surveys, will be helpful in developing the surface water components of the DWSAP.

The California DWSAP Program will be submitted to EPA by early 1999. DHS anticipates that the submitted document will clearly convey to the public and to drinking water utilities the goals and objectives that DHS and EPA seek to accomplish with the DWSAP program, along with methods that are technically appropriate and easily understood.

This document describes California's DWSAP Program and presents the DHS procedures for conducting drinking water source assessments. Although DHS is responsible for performing these assessments, the Department recognizes that some public water systems may wish to perform their own assessments. In such cases, the systems will need to conduct assessments in conformance with the DHS procedures.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## *California Drinking Water Source Assessment and Protection Program*

Public water systems may also choose to perform more complex drinking water source assessments. The water purveyor should contact DHS prior to conducting an assessment in order to receive the latest program documentation.

When a public water system has completed an evaluation through another program that is the functional equivalent of a portion or all of the drinking water source assessment, that information may be submitted for purposes of the drinking water source assessment.

For example, drinking water utilities that utilize surface water sources are required under California law to perform watershed sanitary surveys on a 5-year cycle. Many of the watershed sanitary surveys done prior to the DWSAP Program will most likely adequately satisfy the requirements for the assessment process, other than the public availability requirement. Where watershed sanitary surveys may not be adequate for the DWSAP assessment, the cyclic nature of these surveys offers opportunities to incorporate the requirements of the DWSAP Program.

Groundwater evaluations done for purposes of an Assembly Bill 3030 Groundwater Management Plan may contain information pertinent to DWSAP Program requirements.

This document also contains DHS' recommendations for voluntary protection activities for public water systems and communities.

### **1.1 Description of the DWSAP Program Document**

The development of the DWSAP Program is summarized below and discussed in greater detail in Parts One and Two of this document. The "Source Water Assessment" portion of the program, for which DHS is responsible, is presented in Part Three. The "Source Water Protection" aspects of the program, which are optional and may be enacted voluntarily by drinking water systems or communities, are presented in Part Four.

Fundamental to the assessment and protection elements are issues related to technical data, which will be addressed in appropriate sections of this document.

The DWSAP Program document describes the following:

- The background of the State's DWSAP Program and its goals.
- The minimum acceptable requirements for a drinking water source assessment under the DWSAP Program.
- The State's efforts to ensure public participation, including meeting with other state agencies, the formation of both Technical and Policy Advisory Committees, and public workshops.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

- The roles and duties of government agencies with respect to drinking water source assessment and protection.
- Procedures for performing assessments.
- Guidance for protection programs.

**1.1.1 Assessments**

The DWSAP Program describes DHS' procedures for conducting drinking water source assessments, including:

- Location of the drinking water source
- Delineation of protection areas and zones for both surface water and ground water sources. The surface water source protection areas are defined by the boundaries of the watershed; zones, if delineated, are closer to the drinking water supply. The ground water source protection areas and zones are delineated based on readily available hydrogeologic information on ground water flow, recharge and discharge, and other information deemed appropriate by the State.
- Identification of possible contaminating activities (PCAs) that are considered potential origins of significant contamination within each drinking water source protection area and its zones. PCAs include both microbiological and chemical contaminants that could have adverse effects upon human health.
- Determination of vulnerability of a drinking water source to contamination from an activity within the protection area and zones and the factors that should be considered in the determination.
- Assessments for new drinking water sources by public water systems.

**1.1.2 Protection**

The DWSAP Program includes California's recommendations to encourage voluntary drinking water source protection:

- Descriptions of state actions to support local entities in developing local protection programs. The Program also identifies management approaches that can be used to protect the water supply within a drinking water source protection area from contaminants associated with PCAs. These approaches may include, as appropriate, technical assistance, financial assistance, implementation of control measures, education, training and demonstration projects.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

- Criteria for developing contingency plans indicating the location and provision of alternate drinking water supplies for each public water system in the event of contamination of one or more of the normal sources of supply.

### **1.1.3 Implementation of Assessment and Protection Programs**

The DWSAP Program includes California's approach for implementing assessment and protection activities, including

- Description of the methods DHS will use for assessing California's nearly 16,000 drinking water sources. These methods satisfy the minimum requirements for drinking water assessments.
- Guidance for larger public water systems and others that may choose to perform their own assessments. This guidance states that watershed sanitary surveys already completed satisfactorily for compliance with DHS regulations requirements fulfill most of the assessment requirements for surface water supplies.
- Guidance for implementing successful drinking water source protection programs at the local level.

## **1.2 State Contacts**

To find out more information about the California DWSAP Program, please contact:

Alexis Milea  
Department of Health Services  
Drinking Water Program  
Technical Unit  
2151 Berkeley Way, Room 461  
Berkeley, CA 94704  
(510) 540-2177

Leah Walker  
Department of Health Services  
Drinking Water Program  
Technical Unit  
50 D Street, Suite 200  
Santa Rosa, CA 95404  
(707) 576-2295

The Division of Drinking Water and Environmental Management's Web site, accessible via "Prevention Services" on the DHS Web site at <http://www.dhs.ca.gov>, also contains information on the DWSAP. The site includes a schedule of DWSAP-related events, advisory committee meeting notes, and updates of draft documents related to the program, as well as other material pertinent to California's drinking water.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



## 2.0 DWSAP Program Background, Goals, and Schedule

### 2.1 Background

#### 2.1.1 Requirement and Authority for DWSAP Program Development

The 1986 Amendments to the SDWA established a new Wellhead Protection Program to protect ground waters that supply drinking water wells of public water systems. Under SDWA Section 1428, each State was required to prepare a Wellhead Protection Program and submit it to EPA by June 19, 1989.

The 1996 Amendments to the SDWA established a related program for states, called the Source Water Assessment Program (SWAP). The key elements of this program—protection area and zone delineation, inventory of possible contaminating activities(PCAs), and vulnerability analysis—are also elements of a Wellhead Protection Program.

EPA's guidance indicates that the intent of the 1996 SDWA amendments was to promote source water protection, with assessments being the initial step.

#### 2.1.2 Coordination of the State Source Water Assessment Program

In California, the source water assessment program is being called the Drinking Water Source Assessment and Protection (DWSAP) Program, and it will satisfy the mandates of both the 1986 and 1996 SDWA amendments. The DWSAP Program is intended to address assessments, and also to facilitate the development of protection programs for both ground and surface waters.

The DHS Drinking Water Program is coordinating the effort with technical support from the State Water Resources Control Board (SWRCB). Members of the DHS DWSAP Program Task Force are:

Bob Hultquist (Chair)	DHS Drinking Water, Technical Programs
Alexis Milea	DHS Drinking Water, Technical Programs
Leah Walker	DHS Drinking Water, Technical Programs
Steve Book	DHS Drinking Water Program Headquarters
Jeff Stone	DHS Drinking Water, Technical Programs
Rich Haberman	DHS Drinking Water, Field Operations Visalia District
Cliff Bowen	DHS Drinking Water, Field Operations San Francisco District
Toby Roy	DHS Drinking Water, Field Operations San Diego District
Gunther Sturm	DHS Drinking Water, Field Operations Lassen District
Burt Ellsworth	DHS Drinking Water, Field Operations Northern California Region
Ken Harris	State Water Resources Control Board, Water Quality Division
Judy Bloom	USEPA Region IX, Ground Water Office

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

**2.1.3 Existing Drinking Water Source Protection Programs**

Since Congress passed the Wellhead Protection Program requirement in 1986, wellhead protection has been an active program on the national level. As of 1996, 44 states had wellhead protection programs approved by EPA. The remaining states (California, Alaska, Pennsylvania, Iowa, Florida and Virginia) have some elements of wellhead protection or source water protection in place. The groundwater elements of this DWSAP Program constitute California's Wellhead Protection Program.

In California, a number of communities and counties have wellhead protection or watershed protection programs under development or already implemented.

**2.1.4 Drinking Water-Related Efforts in California**

Under California's surface water treatment regulations, water systems that use surface water for a drinking water supply were required to complete a watershed sanitary survey. This survey included the determination of watershed boundaries and identification of PCAs. January 1, 1996, was the deadline for survey completion and updates are required every five years. As of June 1997, almost all the larger water systems (greater than 1,000 service connections) had completed their surveys. Some small systems have not completed the required surveys, but they will be completed as part of this program.

A number of government agencies, ground water management districts and others have already mapped ground water basins and water supplies within those basins. Some water suppliers, Regional Water Quality Control Boards, and the DHS Drinking Water Program have previously identified PCAs for drinking water sources.

The Groundwater Management Act (Assembly Bill 3030) took effect in January 1993. Under this act, local water agencies or groups of agencies can create their own ground water management plans according to their own requirements and may raise money to run them. A Wellhead Protection Program is an allowable element of an Assembly Bill 3030 Groundwater Management Plan. As of June 1997, 88 Assembly Bill 3030 Groundwater Management Plans had been adopted throughout the state. In addition, there are 42 resolutions of intention to adopt plans, and another 55 agencies considering plan adoption.

**2.2 Goals of the DWSAP Program**

The goals of the DWSAP Program are listed below (not in order of priority):

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

- **Protection and benefit of public water systems of the State.**

The focus of the program is information gathering and attention to activities that may affect drinking water quality to enable communities and public water systems to better protect and manage the surface water and ground water resources of the state

- **Improve drinking water quality and support effective management of water resources.**

The assessments can be used to develop protection strategies that are more economical and desirable than monitoring and treatment of drinking water supplies.

- **Inform communities and drinking water systems of contaminants and possible contaminating activities that may affect drinking water quality or the ability to permit new drinking water sources.**

As communities and public water systems gather information about activities that have contaminated or may contaminate drinking water sources, they will be able to make better decisions about how to protect and manage existing and future drinking water sources.

- **Encourage a proactive approach to protecting drinking water sources and enable protection activities by communities and drinking water systems.**

Water suppliers, communities, planners and the public at large are encouraged to actively manage and plan activities around drinking water sources and within their delineated protection areas and zones to reduce or eliminate the threat of contamination.

- **Refine, focus, and target the monitoring requirements for drinking water sources.**

State and federal regulations require water suppliers to monitor for a long list of inorganic and organic chemicals. With proper identification of PCAs, monitoring requirements can be targeted to the needs of the drinking water source. The result is enhanced public health protection with a potential saving in monitoring costs.

Similarly, regulations require monitoring for microbiological contaminants, some of which may be targeted to specific PCAs. Regulatory limits on other parameters such as turbidity and total organic carbon must also be met by drinking water utilities. To the extent that these "non-chemical" constituents can be controlled by effective assessment and protection programs, they may bring about monitoring and/or treatment relief. Reductions in organic matter in a drinking water source may also result in lower concentrations of disinfection byproducts.

- **Focus cleanup and pollution prevention efforts on serious threats to surface and ground water sources of drinking water.**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

By identifying activities that may pose greater health risks than others to drinking water sources, communities and agencies may be able to prioritize their environmental activities. For example, hazardous waste cleanup, pollution prevention efforts, and other activities of environmental and public health significance that directly improve or protect drinking water supplies may be addressed earlier or allocated more resources than others that are not related to drinking water supplies.

- **Meet federal requirements for establishing wellhead protection and drinking water source assessment programs.**

Compliance with requirements ensures that the California program meets the minimum national standard for source water protection, and is necessary in order to receive future federal source water protection funds.

- **Assist in meeting other regulatory requirements.**

Information that is obtained in the DSWAP Program will be of assistance to state and local agencies, communities and public water systems in meeting various regulatory requirements. Examples include the requirements of the California Environmental Quality Act (CEQA), and upcoming federal regulatory requirements, such as the Groundwater Disinfection Rule and the Enhanced Surface Water Treatment Rule.

### **2.3 Statutory Schedule and Timeline**

States are required to submit a program to EPA within 18 months of EPA's publication of guidance, which occurred on August 6, 1997. Therefore, California must submit its Program to EPA no later than February 1999. California's submittal to EPA for approval will be for both its DWSAP Program and for its Wellhead Protection Program, which is incorporated into the DWSAP.

EPA has nine months to approve California's program. This would occur no later than November 1999.

Thereafter, the State will have two years to complete the assessment for all drinking water sources (November 2001), though an 18-month extension may be obtained (May 2003). US EPA has indicated that it will grant the 18-month extension to states, if requested.

California's time line for completion of assessments for its 16,000 drinking water sources includes the 18-month extension, so that assessments will be completed by May 2003.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

### **3.0. Minimum Requirements for Drinking Water Source Assessments**

This section includes a brief listing of the minimum requirements for a drinking water source assessment, with references to pertinent sections and appendices of the document.

An overall review of the implementation of a drinking water source assessment is presented in Section 9.0, and comprehensive checklists for the submission of the assessment are presented in Appendix G for surface water sources and in Appendix N for ground water sources.

DHS recommends using information that is the functional equivalent of all or some components of the source water assessment to fulfill the DWSAP when such information exists. In other words, if a watershed sanitary survey for a surface water source has been prepared, that information should be used for the DWSAP Program. Similarly, when an evaluation of a ground water basin, as done for example for a Groundwater Management Plan, provides information applicable to a ground water source, that information should also be used.

A public water system that is conducting its own drinking water source assessment and intends to use information that it believes is the functional equivalent of a component of the DWSAP Program, should work with the DHS district engineer to assure that the intended approach satisfies requirements of the DWSAP Program.

#### **3.1 Surface Water Source of Drinking Water**

**✓ Location of the Drinking Water Source.** Section 9.0 and Appendix A.

The location of the surface water intake shall be determined with a global positioning system (GPS) unit.

The accuracy of the GPS unit will be noted.

The location of the drinking water intake will be shown on the assessment map [a US Geologic Survey (USGS) quad map, 7.5 minute series].

**✓ Delineation of Protection Areas and Zones.** Section 6.0, and Appendix B.

Identify watershed boundaries, and show on the assessment map.

Zones are not required, but if they are established, they shall have the following minimum distances (Zone A):

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

400 feet from banks of reservoir  
200 feet from tributaries  
2,500 feet from intakes

**✓ Drinking Water Physical Barrier Effectiveness Checklist.** Section 7.0 and Appendix C.

Evaluate the drinking water source and its site characteristics in terms of the effectiveness of the physical barriers to contaminants reaching the source:

Complete form and make determination of the effectiveness of the source's physical barriers to contamination, based on geology and hydrogeologic considerations: Low, Moderate, or High.

**✓ Inventory of Possible Contaminating Activities (PCAs).** Section 7.0 and Appendix D.

Use checklists to identify PCAs by protection area and zone, if zones are established.

Risk rankings of PCAs may be modified by optional PCA evaluations (Appendix E).

Show location of PCAs on the assessment map. When their locations are known, show them as points on the assessment map. Otherwise, indicate the general area(s) in which the activities exist. (Use available information from local, state, and federal agencies to help develop this information.)

**✓ Vulnerability.** Sections 8.0 and Appendix F.

Evaluate each PCA in terms of its risk ranking, location, and the Physical Barrier Effectiveness of the source. Prioritize PCAs to identify those to which the source is most vulnerable.

**✓ Assessment Map.** Section 9.0 and Appendix G.

An assessment map (USGS quad map, 7.5 minutes series) is required that shows:

1. Location of the drinking water source (surface water intake)
2. Protection area for the source (watershed for surface water source)
3. Zones (optional for surface water sources)
4. Location of PCAs, as points or by zone (watershed if no zones are defined), to which the source is most vulnerable

**✓ Drinking Water Source Assessment Report.** Section 9.0 and Appendix G.

Prepare the assessment as a report for filing at the DHS Drinking Water Program district office.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

The assessment shall include the assessment map containing the information described above, the method and accuracy of the method used to locate the source, delineation calculations, physical barrier effectiveness checklists, PCA inventory forms, PCA and contaminant evaluation forms (if used), vulnerability analysis forms, and other information presented on the checklist in Appendix G.

**✓Public Notification.** Section 9.0 and Appendix G.

Include in the annual water quality report (consumer confidence report) to customers that a drinking water source assessment is available for review at the local DHS district office and, when feasible, at the public water system's office.

### 3.2 Ground Water Source of Drinking Water

**✓Location of the Drinking Water Source.** Section 9.0 and Appendix H.

The location of the drinking water source (i.e., well) shall be determined with a global positioning system (GPS) unit.

The accuracy of the GPS unit will be noted.

The location of the drinking water source will be shown on the assessment map [a US Geologic Survey (USGS) quad map, 7.5 minute series].

**✓Delineation of Protection Areas and Zones.** Section 6.0 and Appendix I.

Identify recharge area and indicate its watershed to the extent possible and show on the assessment map.

Zones are required.

**Minimum acceptable method for determining zones**

[Arbitrary fixed radius, for non-community systems. (For use by DHS only.)]

Calculated fixed radius (CFR) method.

Modified CFR, if direction of groundwater flow is known.

**Minimum distances of zones**

The minimum radii of zones, determined from CFR equation, except for wells in fractured rock aquifers, are:

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

600 feet for Zone A (microbiological)  
1,000 feet for Zone B5 (chemical)  
1,500 feet for Zone B10 (chemical)

For fractured rock aquifers, the minimum radii are:

900 feet for Zone A (microbiological)  
1,500 feet for Zone B5 (chemical)  
2,250 feet for Zone B10 (chemical)

Delineation methods more sophisticated than CFR or modified CFR are not subject to minimum distances.

**Maximum distances of zones**

Zones for a drinking water source need not extend beyond a known hydrogeologic boundary.

**✓ Drinking Water Physical Barrier Effectiveness Checklist.** Section 7.0 and Appendix J.

Evaluate the drinking water source and its site characteristics in terms of the effectiveness of the physical barriers to contaminants reaching the source:

Complete form and make determination of the effectiveness of the source's physical barriers to contamination, based on geology and hydrogeologic considerations: Low, Moderate, or High.

**✓ Inventory of Possible Contaminating Activities (PCAs).** Section 7.0 and Appendix K.

Use checklists to identify PCAs by protection area and zones.

Risk rankings of PCAs may be modified by optional PCA evaluations (Appendix L).

Show location of PCAs on the assessment map. When their locations are known, show them as points on the assessment map. Otherwise, indicate the general area(s) in which the activities exist. (Use available information from local, state, and federal agencies to help develop this information.)

**✓ Vulnerability.** Sections 8.0 and Appendix M.

Evaluate each PCA in terms of its risk ranking, location (zone), and the Physical Barrier Effectiveness of the source. Prioritize PCAs to identify those to which the source is most vulnerable.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program***✓ Assessment Map.** Section 9.0 and Appendix N.

An assessment map (USGS quad map, 7.5 minute series) is required that shows:

1. Location of the drinking water source (well).
2. Protection area for the source (zones plus recharge area for groundwater source)
3. Zones (required for ground water sources)
4. Location of PCAs, as points or by zone, to which the source is most vulnerable.

**✓ Drinking Water Source Assessment Report.** Section 9.0 and Appendix N.

Prepare the assessment as a report for filing at the DHS Drinking Water Program district office.

The assessment shall include the assessment map containing the information described above, the method and accuracy of the method used to locate the source, delineation calculations, PCA inventory forms, PCA and contaminant evaluation forms (if used), physical barrier effectiveness checklists, vulnerability analysis forms, and other information presented on the checklist in Appendix N.

**✓ Public Notification.** Section 9.0 and Appendix N.

Include in the annual water quality report (consumer confidence report) to customers that a drinking water source assessment is available for review at the local DHS district office and, when feasible, at the public water system's office.

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 0 3 0

## PART TWO

### Development of California's DWSAP Program

A description of the public participation in the development of the DWSAP, and the activities of government agencies that are related to drinking water assessment and protection

#### Section 4—Public participation in the DWSAP Program

#### Section 5—Roles and responsibilities of government agencies

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **4.0 Public Participation in the DWSAP Program**

Public participation in developing the DWSAP Program is crucial to the success of the program, because it:

- (1) ensures that interested parties understand the proposed program
- (2) provides technical review of the program elements
- (3) helps forge consensus among parties affected by the program
- (4) ensures that concerns of the public are fully addressed, and
- (5) fosters a closer working relationship between government agencies and the public.

Public involvement in the program itself is required at three different levels. The first level is during the development of the statewide DWSAP Program. The second level is the availability or distribution of drinking water source assessments for public review after they are completed (Part Three of this document). The third level is during development of voluntary local drinking water source protection programs (Part Four).

Listed below are the public involvement steps in the development of the California DWSAP Program.

### **4.1 Stakeholders in the Process**

**Agency stakeholders.** In April 1997 the Department of Health Services convened an interagency group of federal, state and local agencies including: the US Environmental Protection Agency, the US Geologic Survey, the US Bureau of Land Management, the US Bureau of Reclamation, the US Forest Service, the CalFed Program (which deals with issues of San Francisco Bay and the Sacramento River/San Joaquin River Delta), the Department of Water Resources, the State Water Resources Control Board, Regional Water Quality Control Boards (North Coast, Colorado River Basin, Lahontan, Central Valley), the Department of Pesticide Regulation, the Department of Food and Agriculture, the Department of Forestry and Fire Protection, the California Council of Directors of Environmental Health, and local environmental health departments (Riverside County and Contra Costa County).

The purpose of the meeting was to explain the DWSAP Program, identify key players in related programs, and discuss program implementation. The principal issues discussed were standardized mapping to facilitate integration of information, protection areas and zones for delineation purposes, PCA inventories, drinking water source and site characteristics, vulnerability analyses, and public participation.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Other stakeholders.** A list of approximately 120 individuals or representatives from various organizations interested in or potentially affected by the DWSAP program has been developed for California. This list, which represents a broad spectrum of the general public, was used to develop the Public Policy Advisory Committee, described below. Additional people or organizations were added during development of the program.

Stakeholder groups are presented in Table 4-1.

## **4.2 Technical and Policy Advisory Committees**

A Technical Advisory Committee was developed to review and comment on the technical elements of the program. This committee was comprised of technical experts in ground water and surface water and protection (Table 4-2). The Technical Advisory Committee met in August and November 1997 and February, April, and June 1998 to review and comment on proposed program elements.

The Public Policy Advisory Committee included stakeholders who wanted to be actively involved in the program development. DHS sent invitations for the first meeting of the advisory committee to over 120 individuals representing stakeholder business, industry, agriculture, environmental groups, medical and public health advocacy organizations, and others. The committee also met in August and November 1997 and February, April, and June 1998 to review and comment on drafts of the DWSAP program, and on the schedule, format, and agenda for the public workshops.

Members of both the Technical Advisory and the Public Policy Advisory Committees were invited to comment on any aspect of the program, and to attend each other's meetings. Meetings were also open to any interested parties.

## **4.3 Mailing List of Interested Parties**

A DWSAP Program mailing list of approximately 300 was developed, comprised of interested parties, including members of the various advisory committees and the interagency group. Notifications of meetings of the technical and public policy advisory committees and public workshops, along with drafts of the DWSAP Program, were sent to those on the mailing list.

## **4.4 Development and Availability of Draft DWSAP Program Documents for Comment**

Drafts of the DWSAP Program have been submitted to the advisory committees for review and comment. Additionally, drafts have been sent to local, state and federal agencies, the American

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Waterworks Association, Association of California Water Agencies, and other organizations. These groups have been requested to submit comments. As mentioned above, drafts are also provided to those on the DWSAP Program mailing list.

DHS has also made drafts of the DWSAP Program available by posting them on the Internet (via "Prevention Services" and "Division of Drinking Water and Environmental Management" at the DHS Web site, <http://www.dhs.ca.gov>), with a request for comments. DHS is responding to comments submitted by the public during development of the DWSAP program, and intends to indicate its response in its submittal to US EPA. Comments received by e-mail are read and incorporated into revised documents as appropriate, but only those comments received as hard copy are addressed in the more formal response mechanism.

## **4.5 Public Outreach**

### **Materials on the Internet**

Since October 1997, DHS has used its Web site to present information related to the DWSAP Program. The information includes the schedule of advisory committee meetings, workshops, and other activities, notes from those meetings, and other information that provides updates on the program and invites public participation. Copies of this information have been provided to the DWSAP mailing list, and on request to those without Internet access.

### **Staff presentations**

Presentations on the DWSAP Program were made in 1997 and 1998 by DHS staff from headquarters and field offices staff. Information on the programs was presented to professional organizations, water supplier organizations, watershed management groups, and other interest groups and organizations. A list of presentations will accompany the program submittal to US EPA.

### **Public workshops**

Five informational workshops were held around the state (Chino, Fresno, Redding, San Francisco Bay Area, Thousand Oaks) in April and May 1998. These workshops explained the DWSAP Program and invited comments from the general public.

## **4.6 Revisions of the DWSAP Program Document**

Comments and suggestions for improvements from members of the advisory committees, and other comments that DHS staff received from the public (for example, during presentations or workshops) have been incorporated into the DWSAP Program document. The first draft

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

DWSAP was released in October 1997. Revised drafts were made available to the public in January, April, and August 1998.

#### **4.7 Final Public Comment Period**

A public comment period on the final review draft will occur in August-September 1998, in order to receive additional comments and address concerns with the DWSAP program document, prior to its submission to US EPA by February 1999.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



**Table 4.1 Potential Stakeholders****Public Agencies**

Counties  
 Cities  
 Regional Water Quality Control Boards  
 Water Districts  
 Sewage Districts  
 Sanitation Districts  
 Flood Control Districts  
 Ground water Management Districts  
 Resource Conservation Districts  
 Department of Fish and Game  
 Department of Toxic Substances Control  
 Department of Pesticide Regulation  
 Integrated Waste Management Board  
 Office of Environmental Health Hazard Assessment  
 Department of Water Resources  
 Department of Food and Agriculture  
 State Water Resources Control Board  
 Teale Data Center  
 National Resources Conservation Service  
 US Bureau of Reclamation  
 US Environmental Protection Agency  
 US Fish and Wildlife Service  
 US Forest Service  
 US Geological Survey

**Private Companies**

Agriculture  
 Mining  
 Gravel Production  
 Private Water Companies  
 Well Drillers  
 Manufacturing, Petroleum, and other Industries  
 Landfill Operators

**Private Organizations**

Farm Bureau  
 Chambers of Commerce  
 Construction/Real Estate Organizations  
 Well Driller's Groups

Mutual Water Companies  
 Agricultural Groups  
 Environmental Groups  
 Recreational Groups  
 Watershed Conservancies  
 Consumer Groups  
 Rate-payer Groups  
 Water-oriented Associations  
 Planning Associations

**Individuals**

Pumpers  
 Farmers  
 Rate-payers  
 Consumers  
 Educators

**Others**

UC Agricultural Extension  
 Public Health Groups  
 Vulnerable Population Groups  
 Business Groups representing Chemical Manufacturing  
 Tribes

*California Drinking Water Source Assessment and Protection Program*

**Table 4.2 Technical Advisory Committee**

Elaine Archibald	Water Industry Consultant
Norm Brown	Integrated Water Technology
Neil Dubrovsky	US Geological Survey
Pat Dunn	California Department of Pesticide Regulation
Terry Fleming	US Environmental Protection Agency
Carl Hauge	California Department of Water Resources
John Letey	University of California Center for Water & Wildland Resources
Bruce Macler	US Environmental Protection Agency
Maryanne Mann	Metropolitan Water District of Southern California
Jon Marshack	Central Valley Regional Water Quality Control Board
Sue Murphy	California Rural Water Association
Richard Nagel	San Fernando Valley Water Master
Harrison Phipps	Groundwater Resources Association of California
Anthony Saracino	Groundwater Resources Association of California
Paul Veisze	California Department of Fish and Game
Nira Yamachika	Orange County Water District

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **5.0 Roles and Responsibilities of Government Agencies**

A variety of state, local and federal agencies have responsibilities and authority for protection of ground water and surface water supplies. Drinking water source protection does not transfer authority for potential pollution control away from existing agencies. Information developed during source water assessments (delineation, PCA inventory and vulnerability analysis) may be used by agencies with existing authority in setting priorities for technical assistance, outreach, field inspections, enforcement actions and other activities.

Private water purveyors also administer some water-related activities, especially in regard to water importation, recharge, reclamation, pumping, and reuse.

This section will describe the roles and responsibilities of various governmental agencies with respect to the drinking water source assessment and protection program. Information generated and maintained by a number of these agencies is accessible through DHS' directory of source water protection-related activities.

A number of government agencies were contacted to determine their existing activities that may have application in carrying out a drinking water source assessment or in providing information for a voluntary source water protection program. A survey form was sent out and responses were received from the agencies listed below. A compilation of the information received is shown in Table 5-1.

### **Local Agencies**

City of Benicia

Contra Costa County, Environmental Health Division  
Sonoma County, Permit and Resource Management Department  
Placer County Environmental Health Department  
Riverside County, Department of Environmental Health

### **State Agencies**

Air Resources Board, Stationary Source Division  
Department of Water Resources  
Department of Forestry and Fire Protection (CDF)  
State Fire Marshall/ Pipeline Safety and Enforcement Division (Part of CDF)  
Integrated Waste Management Board

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Department of Toxic Substances Control  
 Department of Pesticide Regulation  
 Department of Health Services, Division of Drinking Water and Environmental  
 Management  
 State Water Resources Control Board, Clean Water Programs  
 State Water Resources Control Board, Division of Water Quality  
 State Water Resources Control Board, Division of Water Rights  
 Regional Water Quality Control Board, North Coast Region 1  
 Regional Water Quality Control Board, Central Coast Region 3  
 Regional Water Quality Control Board, Los Angeles Region 4  
 Regional Water Quality Control Board, Central Valley Region 5  
 Regional Water Quality Control Board, Lahontan Region 6  
 Regional Water Quality Control Board, San Diego Region 9

**Federal Agencies**

U.S. Department of Agriculture, Forest Service  
 U.S. Department of Agriculture, Natural Resources Conservation Service  
 Department of the Interior, Bureau of Land Management  
 U.S. Environmental Protection Agency, Region 9

**State/Federal Agency**

CalFed Bay Delta Program

## **5.1 Local Agencies**

### **5.1.1 Counties and Cities**

California has 58 counties, 34 of which are designated Local Primacy Agencies (LPAs) to carry out the regulation of small public water systems.

Besides its counties, California also has more than 444 incorporated cities and many other municipalities. These local governments are often concerned with ensuring the availability of high-quality ground water supplies to residents. State enabling legislation gives local governments variable powers and duties, depending on how they were formed, to protect water supplies.

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

A variety of water-related activities are undertaken by county and city governments. These include:

- Ground Water Recharge
- Hazardous Materials Spills Emergency Response
- Hazardous Waste Management Planning
- Land Use Planning and Zoning
- Large and Small Water Supply Systems Monitoring
- Pesticide Regulation by County Agricultural Commissioners
- Regulation of Individual Waste Disposal (Septic) Systems
- Regulation of Underground Storage Tanks
- Sanitary Landfill Ground Water Monitoring
- Solid Waste Management Planning
- Water Well Permitting
- Watermaster for an Adjudicated Basin

### **5.1.2 Special Districts**

California has thousands of special districts that undertake or have authority for activities related to drinking water source assessment and protection. The types of districts include: Flood Control and Water Conservation Districts, Public Utility Districts, Community Services Districts, Sewer and Sewer Maintenance Districts, Storm Water Drainage and Maintenance Districts, Water Replenishment Districts, Reclamation Districts, Irrigation Districts, Levee Districts, Local Drainage Districts, Resource Conservation Districts and Water Conservation Districts.

The drinking water protection related activities that these districts undertake may overlap those of cities and counties. The activities include:

- Ground Water Management
- Control/Correction of Saline Water Intrusion
- Ground Water Recharge
- Land Reclamation
- Watershed Protection
- Water Conservation
- Irrigation Water Supply
- Sewer Construction and Maintenance
- Drinking Water Supply
- Sewage Collection, Treatment and Disposal
- Power Supply
- Refuse Disposal
- Soil Conservation
- Wet, Swamp and Overflowed Land Drainage

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Local governments sometimes expand and coordinate activities through "Joint Powers Authorities" pursuant to §6500 et seq. of the California Government Code, which includes the formation of separate agencies or entities.

## **5.2 State Agencies**

A number of State agencies, boards, departments, and offices share responsibility with federal and local agencies for ground and surface water protection in California (see Table 5-1). They are identified and their roles briefly described below:

The **Health and Welfare Agency** houses the **Department of Health Services (DHS)**:

### **Division of Drinking Water and Environmental Management (DDWEM)**

The DDWEM, within DHS, promotes public health through the regulation and monitoring of public water systems, wastewater reclamation projects, disposal of low level radioactive waste, shellfish production and harvesting operations, and medical waste generators.

DDWEM is responsible for carrying out the federal Safe Drinking Water Act (SDWA) in California. Activities of DDWEM related to drinking water source assessment and protection are primarily conducted by the Drinking Water Field Operations Branch (DWFOB) and the Drinking Water Technical Programs Branch (DWTPB).

The DWFOB is responsible for the inspection and regulatory oversight of approximately 8500 public water systems to assure delivery of safe drinking water to all California consumers. There are 15 district offices distributed widely throughout the state. Activities involved in the oversight of public water systems include issuing permits, performing inspections of existing facilities, reviewing plans for new facilities, issuing administrative orders and citations to public water systems for violations of laws and regulations, and ensuring that public water systems comply with water quality standards and monitoring requirements.

The DWTPB is responsible for providing technical support for the drinking water program and carrying out its administrative functions. The branch is composed of the Technical Operations Section and the Technical Programs Section. The Technical Operations Section administers its programs through several units: Certification Unit (certification of water treatment operators and water treatment devices), the Standards and Technology Unit (development of monitoring and water quality regulations and conduct special studies and programs), and the

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Recycled Water Unit (development of recycled water criteria and regulations, proposal evaluation and recommendations). The Technical Programs Section includes the Data Management Unit, which collects, compiles, evaluates and reports drinking water quality data from large and small drinking water systems in the State.

The **California Environmental Protection Agency (Cal/EPA)** serves as the point of accountability for the management of the State's environmental protection programs, bringing together functions that cut across various programs designed to address environmental pollution. Organizations in Cal/EPA are:

**State Water Resources Control Board (SWRCB)**

The SWRCB formulates and adopts the State's policy for water quality control, assisting and overseeing the Regional Water Boards, and in conjunction with the courts, administers California's system of water rights.

**Regional Water Quality Control Boards (Regional Water Boards)**

The nine Regional Water Boards formulate, adopt, and implement (with State Water Board approval) water quality control policies and plans within their jurisdiction. Collectively, the nine Regions cover all of California. Each Regional Water Board designates beneficial uses of surface and ground water resources, and establishes water quality objectives to reasonably protect existing and potential beneficial uses of water resources in its region, as well as implements programs to achieve compliance with the water quality objectives. Beneficial uses, water quality objectives, and the implementation program are specified in each region's Water Quality Control Plan, as called for in the California Water Code, §13240.

Regional Board activities related to drinking water source assessment and protection include:

**Basin Planning**

Each Regional Water Board has adopted one or more Water Quality Control Plans (Basin Plans) for their jurisdiction, which is based upon surface water hydrologic basin boundaries. The Basin Plans identify existing and potential beneficial uses of marine, ground, and surface waters; establish water quality objectives to protect the beneficial uses; specify implementation programs to achieve these objectives; and describe surveillance and monitoring activities to evaluate the effectiveness of the water quality program.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Basin Plans contain standards for surface water and ground water quality that are independently established by each Regional Water Board as water quality objectives necessary to protect the identified beneficial uses. Thus, there are differences both among and within Regions, depending upon the particular ground water basin and the assigned beneficial uses.

National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirements

Under the authority of the federal Clean Water Act, the NPDES program regulates point source discharges to surface waters such as wetlands, lakes, rivers, estuaries, bays and oceans. In California, the Porter-Cologne Water Quality Control Act regulates any discharge of waste that may affect water quality in California. Waste discharges are declared to be a privilege, not a right, and require permission from the applicable Regional Water Board.

Waste Discharges to Land

The State Water Board has adopted regulations (California Code of Regulations, Title 23, Chapter 15, and Title 27) which implement provisions in the Porter-Cologne Act. These regulations apply to all hazardous and non-hazardous wastes discharged to land, including surface impoundments. The Chapter 15 regulations prescribe siting standards, construction standards, ground water and vadose zone monitoring requirements, and closure and post-closure procedures and requirements.

Protecting ground and surface water from the migration of contaminants from solid waste disposal facilities is the responsibility of the State and Regional Water Boards. This responsibility is executed by requiring all solid waste disposal facilities to conform to waste discharge requirements adopted by a Regional Water Board.

Hazardous Waste Facility Monitoring

Under a Memorandum of Agreement with DTSC, the State and Regional Water Boards carry out a ground water monitoring and surveillance program, perform water quality-related review work, and develop regulations, standards, and guidelines pursuant to the federal Resource Conservation and Recovery Act (RCRA).

Underground Storage Tanks

In 1983, the California Legislature enacted underground tank legislation requiring an inventory of underground storage tanks along with a program to permit their continued use. The State Water Board, the nine Regional Water Boards, and local agencies share responsibility for enforcement and cleanup. The State Water Board compiled the inventory of underground containers in California and

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

provided this information to the appropriate Regional Water Boards, cities, and counties. The container inventory, as directed by the legislation, also included pits, ponds, sumps, and lagoons, each storing a wide variety of substances.

The State Water Board established standards for the monitoring of existing tanks and the construction of new ones. These, along with requirements for repair and closure, are described in the California Code of Regulations, §2610 et seq.

Non-Point Source Pollution

The federal Clean Water Act was amended in 1987 to include Section 319, which required the states to develop and implement non-point source management programs. The State Water Board subsequently adopted a "Non-point Source Management Plan" in 1988, and by early 1990, had organized a multi-faceted, surface and ground water, non-point source program which focused on agriculture, mining, urban runoff, construction, and pesticides. The non-point source program seeks to reduce or eliminate surface and ground water pollution through the implementation of management measures to control non-point source pollution at its source.

Remediation

The Regional Water Boards, in responding to a surface or ground water pollution problem or nuisance, may issue a "cleanup and abatement" order to any responsible party to require corrective action. Their authority covers all discharges of waste, hazardous or otherwise, which enter or threaten to enter surface or ground water.

Coastal Zone Act Reauthorization Amendment (CZARA) of 1990

The two primary federal statutes that establish a framework for address nonpoint source (NPS) pollution are Section 319 of the Clean Water Act (1987) and Section 6217 of the CZARA. Together, they encourage states to assess water quality problems associated with NPS and to develop programs to control NPS sources of pollution. CWA §319 requires that states develop an assessment report and a management program specifying NPS controls. CZARA §6217(a) requires states to establish coastal NPS programs to develop and implement management measures for NPS pollution to restore and protect coastal waters. California received \$5.4 million of federal funding under the CWA in 1997 to carry out its NPS program.

In 1988, the SWRCB adopted the California NPS Management Plan that outline a three-tiered approach for address polluted runoff: (1) voluntary implementation of Best Management Practices (BMPs), (2) regulatory-based encouragement of BMPs, and (3) effluent limitations. In response to CZARA §6217, the SWRCB, the RWQCBs, and the California Coastal Commission initiated a joint effort to

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

improve the state-wide NPS program and comply with CZARA requirements. As a result, California is working to enhance its state-wide NPS program by better utilizing existing state authorities and programs, pursuing watershed approaches, and encouraging voluntary cooperation.

**Department of Toxic Substances Control (DTSC)**

The DTSC protects public health and the environment from the improper handling storage, transport, and disposal of hazardous substances.

DTSC's primary activities related to drinking water source assessment and protection are included in two programs mandated by federal law:

**Resource Conservation and Recovery Act (RCRA)**

Under the federal Toxic Substances Control Act, the USEPA regulates the treatment, disposal (including incineration, landfill, alternative technology), and storage of hazardous chemical substances. The federal RCRA Program has been delegated to DTSC. This program regulates the treatment, transportation, storage and disposal of hazardous waste.

DTSC, under Health and Safety Code §25100, issues permits that govern the general operation of hazardous waste management facilities. They specify conditions on the way hazardous materials may be transported, handled, treated, stored, or disposed. The permits also impose conditions for waste analysis, record keeping, site monitoring, containment procedures, site improvements, closure procedures, and financial responsibility.

**California Superfund Program**

DTSC is authorized by California's Hazardous Waste Control Law and Hazardous Substance Account Act (California Superfund) with enforcement powers for the cleanup of hazardous substances. Their program complements the federal "Superfund" program and provides for: (1) cleanup or impact reduction at hazardous waste sites, (2) response capability to State and local agencies in hazardous substance emergencies, and (3) compensation to persons who suffer loss or injury caused by the release of a hazardous substance.

DTSC specifies their approach in their *Preliminary Endangerment Assessment Guidance Manual*. The DTSC cleanup strategy is based on a health risk assessment approach.

**Department of Pesticide Regulation (DPR)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

DPR regulates the use and management of pesticides to prevent pollution of surface water bodies and ground water aquifers that may be used for drinking water supplies, as mandated in the State Pesticide Contamination Prevention Act (1986).

DPR is responsible for regulating the sale and use of pesticides, evaluating and mitigating environmental and human health impacts of pesticide use, and promoting alternative pest control strategies. The DPR program relies on authorities in the California Food and Agriculture Code (§13141 et seq.).

Additional authorities in the California Pesticide Contamination Prevention Act require the DPR to carry out specific activities to prevent ground water from being contaminated. Prevention is the preferred goal, because once ground water has become contaminated, cleanup activities are very difficult, expensive, and time consuming. This Act requires: (1) Pesticide registrants to submit specific information to the DPR regarding the impacts of their products on ground water; (2) DPR to identify pesticides that have the potential to pollute ground water to be put on a Ground Water Protection List; and (3) DPR to conduct a monitoring program for pesticides in soil and ground water.

As specified in a Memorandum of Understanding between DPR and the State Water Board, DPR is the first agency to respond to any detection of a pesticide in surface water or ground water with voluntary measures and/or regulatory action.

**Integrated Waste Management Board (IWMB)**

The IWMB oversees the safe treatment, storage, recycling, disposal of solid waste by local agencies.

**Air Resources Board (ARB)**

The ARB regulates emissions of air pollutants that can effect the quality of surface and ground water.

**Office of Environmental Health Hazard Assessment (OEHHA)**

OEHHA provides information to environmental regulators and the public about adverse health effects that result from environmental exposures to noninfectious agents.

OEHHA's mission is to protect and enhance public health and the environment by objective scientific evaluation of risks posed by hazardous substances.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

OEHHA's functions and responsibilities related to drinking water source assessment and protection include developing health-protective exposure standards for different media (air, water, land) to recommend to regulatory agencies, including drinking water chemical contaminant standards for DHS. OEHHA's Water Toxicology Unit performs major risk assessment and hazard evaluations relating to chemical contaminants in drinking water. These activities include developing health advisories, action levels, proposed maximum contaminant levels, and public health goals for chemical substances, additives, and pollutants in drinking water and on chemical monitoring activities for the drinking water supply. The program also provides education to the public and other governmental agencies on drinking water contamination and regulatory standards development.

OEHHA is responsible for implementing the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). This initiative statute prohibits businesses from discharging into drinking water sources chemicals identified by the State to cause cancer or reproductive toxicity. It also requires warnings to be provided whenever exposures to those chemicals are anticipated to occur.

The **Resources Agency** includes several pertinent departments:

**Department of Water Resources (DWR)**

The DWR develops, conserves, and manages the water resources of the State.

The mission of the Department of Water Resources is to manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.

Major responsibilities of the Department include preparing and updating the California Water Plan to guide development and management of the State's water resources. The State and Regional Water Boards must consider this Plan in their decisions. In addition, the Porter-Dolwig Ground Water Basin Protection Law (California Water Code §12920 et seq.) gives the DWR authority to initiate or participate in investigations, studies, plans and design criteria for projects to prevent degradation of ground water throughout the State.

The Department also administers increasingly complex programs involving flood control for the Central Valley, dam safety for more than 1,200 dams statewide, local assistance projects, water management strategies, water quality improvement, and water supply data collection and studies. DWR staff provides technical and financial assistance to local water communities; works with a number of governmental and wildlife agencies on environmental issues and

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

projects; manages State Water Project and Reclamation Board lands; educates the public about California's water resources; and operates and maintains the State Water Project.

DWR provides support for the use of ground water through the distribution of hydrogeologic studies and other technical information. In addition, well drillers are required to file a report to DWR on each well drilled.

**Department of Conservation (DOC)**

Among other functions, the Division of Oil, Gas, and Geothermal Resources (DOGGR) within the DOC acts to prevent contamination of ground water due to the drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells. This includes both extraction and injection wells.

The State Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) issues permits for the approximately 21,000 Class II (oil/gas production) injection wells in California. These are accepted by the USEPA for the Underground Injection Control program under one Memorandum of Understanding with DOGGR and accepted by the Regional Water Boards under another Memorandum of Understanding.

**California Department of Forestry and Fire Protection (CDF)**

The Department of Forestry and Fire Protection protects the people of California from fires, responds to emergencies, and protects and enhances forest, range and watershed value providing social, economic and environmental benefits to the citizens of the State. Managing California's natural resources is an important part of the Department's mission. CDF oversees enforcement of California's forest practice regulations. This includes review of Timber Harvest Plans submitted by private landowners and logging companies who want to harvest trees on their property. CDF also operates six Demonstration State Forests where research and experiments in forest management are conducted.

**State Fire Marshal, Pipeline Safety Division (CSFM)**

Within CDF, the California State Fire Marshal has the exclusive responsibility of regulating and enforcing safety on all intrastate hazardous liquid pipelines within the state, including some of the pipelines coming from offshore platforms located within three miles of the California coast.

CSFM is also recognized as an interstate agent of the United States Department of Transportation's Office of Pipeline Safety (OPS). As such, CSFM is responsible

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

for inspection, investigation and emergency response concerning interstate pipelines.

**The Department of Food and Agriculture (DFA)** is a cabinet level agency.

Among other functions, DFA inventories agricultural operations, dairies, and animal feedlots. DFA also investigates water quality issues involving the accumulation of nitrate in ground water.

### **5.3 Federal Agencies**

Federal water programs are administered primarily by the U.S. Environmental Protection Agency. The U.S. Army Corps of Engineers, the U.S. Department of Agriculture (USDA) and other federal agencies play complementary roles. The U.S. Geological Survey (USGS) principally compiles information that assists others in their water protection efforts.

#### **National Resources Conservation Service (NRCS)**

NRCS (previously known as the Soil Conservation Service) has a long history of addressing non-point source pollutants by working with farmers and communities through voluntary implementation programs. NRCS assistance has primarily focused on nutrients, pesticides, sediment, animal wastes, and salinity issues in surface and ground waters. Assistance encompasses planning and preventive measures to small scale monitoring and suggestions of conservation practices to help solve non-point source pollution problems. NRCS also offers point, field and watershed models to predict the transport and fate of these parameters in surface and subsurface waters.

#### **US Geological Survey (USGS)**

The role of the USGS is to serve as the primary earth sciences research agency in the United States. The Survey has no regulatory or management responsibilities, and is focused entirely on the need to provide sound scientific data, information, and assessments in support of those agencies that have regulatory and management responsibilities for geologic, hydrologic and, now, biologic resources.

#### **U.S. Environmental Protection Agency (US EPA)**

Several federal programs related to drinking water source assessment and protection are administered by the U.S. Environmental Protection Agency. The primary purpose of the Safe Drinking Water Act (SDWA) is to ensure the safety of drinking water served to the

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

public. The SDWA includes the Wellhead Protection Program, the Sole Source Aquifer Program, and the Underground Injection Control Program.

Other federal environmental laws to protect water supplies include, but are not necessarily limited to, the Clean Water Act (CWA) which ensures protection of surface waters designated, in part, for use as drinking water; the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, otherwise known as "Superfund"), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). These laws provide authorities, financial support, and technical assistance to protect sources of drinking water, especially ground water.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



**TABLE 5-1 Matrix of Government Agency Roles for Drinking Water Source Assessment and Protection**

[illegible]

M = Monitoring  
Po = Policy  
A = Analysis  
P = Planning  
O = Oversight  
E = Education/Information  
Rg = Regulatory (permit, inspection, enforcement)  
D = Data Collection  
R = Review/Comment  
T = Technical Assistance  
F = Financial Assistance  
S = Standards development

## Notes

1. Regional Boards responding to survey: San Diego, Los Angeles, Lathropian, Central Valley, North Coast, Colorado River Basin, Central Coast.
2. Counties responding: Placer, Riverside, Sonoma, Contra Costa.
3. Cities responding: Benicia

c:\winamp\mp3\cd\7\subject1



## PART THREE

### Source Water Assessments

A description of the procedures DHS will use in conducting source water assessments for ~16,000 active drinking water sources in California

Section 6—Delineation of protection areas and zones

Section 7—Inventory of activities within protection areas

Section 8—Vulnerability of drinking water sources to possible contaminating activities

Section 9—Implementation of source water assessments

Section 10—New drinking water sources

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 0 5 6

## 6.0 Delineation of Protection Areas and Zones

The delineation step in the assessment defines the boundaries of the areas to be evaluated. Appendices A and B should be used for source location and delineation of surface water sources, and Appendices H and I, for ground water sources.

### 6.1 Delineation for Surface Water Sources

The overall protection area for surface water sources in the DWSAP Program is the area within the boundaries of the watershed that is tributary to the surface water intake. This is consistent with California Code of Regulations, Title 22, Chapter 17, Section 64665, which requires each public water system with a surface water source to conduct a watershed sanitary survey. In December 1993, a Watershed Sanitary Survey Guidance Manual was prepared by the American Waterworks Association (AWWA), California/Nevada Section, Source Water Quality Committee, in conjunction with the DHS Division of Drinking Water and Environmental Management. The guidance specifies that the area to be surveyed should include the entire watershed boundary.

As an option, in addition to the overall protection area, a public water system may desire to establish zones closer to the surface water intake. The purpose of these zones is to define portions of the watershed where activities have a higher risk of contaminating the water supply. Within the zones, there could be a more thorough evaluation of activities that occur there. The zones would aid in establishing both the appropriate levels of surveillance and management (or voluntary protection) approaches.

The zones are useful in conducting source water assessments. California surface water treatment regulations require water purveyors to survey the entire watershed. If zones are established, DHS may allow a less detailed review on portions of the watershed outside the zones. In addition, in the vulnerability analysis (Section 8.0), surface water sources that have zones defined will be able to assign less risk to possible contaminating activities (PCAs) located on the watershed, but outside of the zones. If zones have not been defined, PCAs are considered to be of equal risk, regardless of their location on the watershed.

To establish zones for surface water sources of drinking water, a variety of methods may be used. These include:

1. **Fixed Distance:** In this method, an example of which is shown in Figure 6-1, setbacks from reservoir boundaries, tributaries and/or the intake may be established by using fixed distances. This method, while not technically sophisticated, is relatively simple to implement.

*California Drinking Water Source Assessment and Protection Program*

**2. Time-of-Travel:** In this method, the protection zone is actually a stream reach rather than an area. This method is typically used for determining response times for spill events. The time-of-travel between an upstream monitoring point and the point of interest is calculated. Potential contaminants with a certain time-of-travel would be of primary concern.

**3. Modeling:** Surface runoff and ground water discharge models can be used to assess the impact of individual contaminants from possible contaminating activities (PCAs), and to identify areas within the watershed with the greatest potential impact on drinking water source quality.

Regardless of the method used, factors that may be considered in determining zones include topography (slopes), soils, geology, vegetation, precipitation, hydrology and land uses.

Establishment of zones, if done by public water systems or communities, should be done in consultation with DHS.

Interested water suppliers, communities or groups that require additional information may wish to refer to the EPA document, *State Methods for Delineating Source Water Protection Areas for Surface Water Supplied Sources of Drinking Water* (US EPA, 1997).

If zones within the watershed are established for a surface water source, DHS recommends that they be at least 400 feet from reservoir boundaries, 200 feet from tributaries, and 2,500 feet from intakes.

### **Ground water under the influence of surface water**

For drinking water sources that have been classified as ground water under the direct influence of surface water (GWUDI), the protection area must include the land area within the watershed boundaries. This is consistent with DHS regulations, because GWUDI wells are considered surface water sources and are subject to surface water treatment regulations. Zones for these sources may be established by ground water methods and/or surface water methods.

For drinking water sources that are indirectly under the influence of surface water (e.g. where the source of water is underflow of a surface water body, and the source has not been classified as GWUDI) it is appropriate to include the land area within the watershed boundaries in the protection area. The recharge area, if different than the watershed area, may also be included in the protection area. Zones are to be established using ground water methods. The areas to be assessed should be determined in consultation with DHS.

## **6.2 Delineation for Ground Water Sources**

The protection area for a ground water source includes the recharge area plus, where the recharge area is separate from the well, the area within the delineated zones established for the well. The

*California Drinking Water Source Assessment and Protection Program*

protection area also includes a buffer zone, if one is established. These areas and zones are described in this section.

### **6.2.1 Types of Aquifers**

The DWSAP Program assumes two primary types of aquifers for ground water sources: porous media and fractured rock. It is acknowledged that there are additional types of aquifers in California, but this program uses a simplified approach by categorizing sources into one of these two types. A water system conducting its own assessment may use a different approach with review and approval by DHS.

For **porous media aquifers**, open spaces within the aquifer are assumed to exist between individual particles that comprise the aquifer. In a typical porous material, such as sediment (e.g., sand and gravel), the openings are primary—that is, they represent the spaces between grains that were formed when the sediment was originally deposited. Consequently, they are numerous and random in occurrence. As a result, the concentration and orientation of the open spaces tends to be isotropic (uniform in all directions) within the aquifer. Ground water flow is controlled primarily by gradient direction in porous media.

In **fractured rock**, the primary open spaces are assumed to consist of discrete fractures within the rock material that makes up the aquifer. Fractures tend to develop in a specific orientation with respect to the direction of applied stress. As a result, the fractures may not be random in their orientation and the aquifer's porosity may be anisotropic (not uniform in all directions). Ground water in an anisotropic medium will be driven in a down-gradient direction. However, it may be forced to move along the fractures, which often are in directions other than the gradient direction.

### **6.2.2 Recharge Areas**

The overall protection area for a ground water source includes the recharge area. Recharge areas, which may be natural or artificial, are land areas that contribute water to an aquifer. Recharge occurs naturally from lakes, wetlands, direct precipitation, stream inflow, and subsurface inflow from upgradient sources of groundwater. Figure 6-2 is an illustration of a recharge area.

Artificial recharge can occur as a result of injection wells and man-made facilities such as spreading grounds, unlined canals, and activities such as irrigation practices. Wells and bore holes can act as conduits to aquifers.

### **Porous Media Aquifers**

The **primary** recharge area consists of the area with permeable alluvial materials directly overlying an unconfined or semi-confined aquifer, where there is direct percolation of water into the unconfined or semi-confined aquifer. The primary recharge area for a confined aquifer also consists of the permeable materials, but the recharge area may be

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

several or many miles away from the area of the confined aquifer from which extraction takes place.

**Secondary** or upland (i.e., watershed) recharge areas include the land at higher elevations usually consisting of a rock type that is much less permeable than the alluvial materials. Water recharges aquifers from these areas by overland flow of surface water and infiltration from stream flow into fractures in the rock. The groundwater in these fractures may then recharge groundwater in the alluvial aquifers.

**Fractured Rock Aquifers**

Recharge areas for fractured rock aquifers are similar to those for porous media, but because flow patterns are typically more complex, recharge area boundaries are more difficult to determine. Fractured rock aquifers can also exist in either confined or unconfined settings. In unconfined or poorly confined conditions, these aquifers can have very high flow (and contaminant transport) rates under rapid recharge conditions such as storm events. Transport times across fractured rock flow systems may be as short as hours to weeks, much more brief than in porous media aquifers.

Fractured rock aquifers generally have relatively little storage capacity in the pore space of the aquifer compared to porous media aquifers. If they are capable of significant water supply, this is usually the result of interconnections with alluvial aquifers or surface water bodies. They are characterized by rapid and large rises in the water table during recharge/maximum flow events, and can be influenced by recharge from a large portion of the effective drainage basin. For this reason, in the DWSAP Program the initial estimates of the boundaries of a recharge area for a well in a fractured rock aquifer are the general physical boundaries of the drainage basin.

The recharge area for each ground water source should be identified to the extent possible from a review of the topography, hydrogeology, and other information for the area. The approximate location of the recharge area should be included on the map required for the drinking water source assessment. An assessment of the entire recharge area is not required for this program, but may be useful to a water purveyor.

Where ground water recharge areas can be identified, it is recommended that protection areas encompassing the recharge areas be established. Determining these protection areas should be done in consultation with DHS.

Though the recharge area for a ground water source may be some distance away, defining protection zones immediately around the ground water source provides a starting point for PCA inventories and protection efforts.

Even ground water sources that are in confined aquifers where the recharge area is located at a distance are susceptible to nearby activities that may cause contamination (e.g., improperly constructed wells, or abandoned, improperly destroyed wells).

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



### **6.2.3 Delineation Methods for Ground Water Zones**

According to the 1986 Safe Drinking Water Act Amendments, ground water protection or wellhead protection areas are defined as "the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field".

The pumping of wells within an aquifer results in artificially induced changes (such as drawdown and cones of depression) to the natural ground water system. (See Figure 6-3). For purposes of the DWSAP, the ground water protection area is located adjacent to and surrounding a well. Zones are established within a delineated area to provide for different levels of protection. In unconfined and semi-confined aquifers, the zones are a subset of the recharge area.

In confined aquifers, the zones are adjacent to and surrounding the well, but the recharge area may be located at a distance from the area immediately associated with the well, as discussed above. Unconfined aquifers may also have primary recharge areas at some extended distance from the well. Table 6-1 presents information about the confinement of aquifers.

There are a number of methods for defining zones for ground water sources. The methods recommended for use in California are listed below with a brief description. The primary criterion to be used is time-of-travel (the time for ground water to travel from a point in an aquifer to a pumping well). Particular contaminants may travel faster or slower than ground water. It is generally rare that contaminants move faster than water within an aquifer. In some cases, contaminants (e.g., free phase solvents) are not necessarily subject to the same limitations as water. With the exception of defining a zone immediately adjacent to the well, the time-of-travel criterion is more accurate for estimating protection areas and zones than an arbitrary distance approach.

Delineation methods range from simple to complex, requiring varying amounts of hydrogeologic data and technical expertise. Simpler methods may be done initially to approximate the zones and to determine where more detailed hydrogeologic data is needed. If necessary, the delineations can be refined at a later date using a more complex method if the drinking water source is determined to be vulnerable to PCAs.

*California Drinking Water Source Assessment and Protection Program*

There are six primary delineation methods selected for use in California, in order of increasing technical sophistication.

1. Arbitrary fixed radius
2. Calculated fixed radius
3. Modified calculated fixed radius
4. Analytical methods
5. Hydrogeologic mapping
6. Numerical flow/transport models

These methods range from simple and inexpensive to highly complex and costly. It is important to note that more than one method can be used to determine protection areas and zones for a ground water source. When resources, site-specific information and technical expertise are available, the more sophisticated analytical, mapping or modeling methods can be used to provide a higher degree of accuracy. Listed below is a description of each method.

**Arbitrary Fixed Radius**

This method involves drawing a circle of a specified radius around a well being protected. The radius is a reasonably conservative minimum distance determined by DHS based upon general hydrogeological considerations and professional judgement. In the DWSAP program this method may only be used for non-community water systems.

**Calculated Fixed Radius**

This method involves drawing a circle around a well to estimate the zone of contribution (ZOC) for a specified time-of-travel criterion. A radius is calculated using Equation 6-1 shown below that is based on the theoretical volume of water that will be drawn to a well in the specified time. The input data required by the equation includes the pumping capacity of the well, the screened interval of the well and the effective porosity of the aquifer. The time period to be used is described in Section 6.3.4.

The protection zone determined by the calculated fixed radius (CFR) (Equation 6-1) is a circle that extends the same distance in all directions from the well. In an area with a flat water table, this is a reasonable approximation of the zone of contribution. This method provides a more accurate estimate of the appropriate size of zones than the arbitrary fixed radius method, but may still be inaccurate because it does not take into account the actual rate and direction of ground water flow, recharge and other factors that may influence contaminant transport.

*California Drinking Water Source Assessment and Protection Program*

The equation for the calculated fixed radius is

$$R_t = \sqrt{Q t / \pi n H} \quad \text{Equation 6-1}$$

$R_t$  = radius of zone (feet) for time period  $t$

$Q$  = pumping capacity of well ( $\text{ft}^3/\text{year}$ ), where  $\text{ft}^3/\text{year} = \text{gpm} \times 70,267$

$t$  = travel time (years) (2, 5, or 10 years, as described in Section 6.3.4)

$n$  = effective porosity (decimal percent)

$H$  = screened interval of well (feet)

The pumping capacity to be used is the maximum rate the well can be pumped, in gallons per minute converted to the equivalent in cubic feet per year. Pumping capacity of the well should be known by the water purveyor. If the capacity is unknown, the purveyor may conduct a pump test to determine the appropriate value. If that is not possible, an estimate can be made if justification is provided. If there are no references to use to estimate the pumping rate, DHS should be consulted for assistance in determining the appropriate value to use in the delineation.

The length of screened interval to be used in the equation should be based on well construction information. If the actual value is unknown, an initial estimate can be made equal to 10% of the pumping capacity of the well in gallons per minute (gpm), with a minimum of 10 feet. For example, the estimated screened interval for a well that pumps at 400 gpm is 40 feet.

Effective porosity should be estimated using available information for the aquifer. However, if a value is not known, a value of 0.2 can be used for an initial calculation. The estimated value of 0.2 for effective porosity is reasonably conservative for most aquifers in California based on available information.

Figure 6-4 is an illustration of the CFR method. Figure 6-5 is a conceptual illustration of the three zones using the CFR method.

### **Modified Calculated Fixed Radius Method**

In an area with a sloping water table (the most common situation), the circle described by Equation 6-1 tends to overestimate the zone of contribution (ZOC) in the down-gradient direction and to underestimate the ZOC in the up-gradient direction. To address this situation, the DWSAP provides a modified calculated fixed radius approach for sites where the direction of ground water flow is known. This approach is appropriate for ground water sources located in porous media aquifers.

In the modified approach, the radius is calculated using Equation 6-1 and the associated input data. The upgradient extent of the zone is determined as **1.5 R** (e.g., one and one-half times the calculated radius). The down-gradient extent of the zone is **0.5 R** (e.g., one-half the calculated radius). The resulting shape is a circle with a radius of **R**, shifted upgradient by a distance of

*California Drinking Water Source Assessment and Protection Program*

**0.5 R.** Figure 6-6 is a conceptual illustration of the three zones using the modified CFR method. The sizes of the zones in the modified CFR are the same as those determined by the CFR method (Figure 6-5).

If a water purveyor wishes to use the modified CFR method, the calculations used to determine the direction of ground water flow must be submitted with the assessment report (see below).

**Estimation of direction of ground water flow.** In order to accurately estimate the direction of ground water flow, the estimate must use at least three (3) wells in the vicinity of the drinking water well. For the three wells, the topographic elevation at each well, the distances between the wells, and the total head at each well must be known. Ground water "contours" or equipotential lines are determined from the information for the three wells, and the ground water flow direction is perpendicular to the contour lines. For more information in determining the direction of ground water flow, refer to the EPA document *Ground Water and Wellhead Protection*, pages 30 to 31 (US EPA, 1994).

The "total head" is the water level in a well, usually expressed as feet above sea level, which consists of the elevation head and the pressure head. In an unconfined aquifer, the pressure head equals zero at the water table surface.

### **Analytical Methods**

These methods involve the use of equations to define ground water flow and contaminant transport. The uniform flow equations (Todd, 1980) shown in Figure 6-7 are often used to define the area of contribution to a pumping well in a sloping water table. These are the most widely used methods for accurately delineating ground water protection areas and zones.

These methods require the input of various hydrogeologic parameters to calculate the distance to the downgradient divide, or stagnation point, and the width of the zone of contribution to the well. The upgradient extent of the protection area can then be calculated based on either a time-of-travel or flow boundaries criterion. Site specific hydrogeologic parameters are required as input data for each well at which the method is applied. These parameters can include the transmissivity, porosity, hydraulic gradient, hydraulic conductivity, and saturated thickness of the aquifer.

Figure 6-8 illustrates an example of a protection area determined by using the analytical methods.

### **Detailed Hydrogeologic Mapping**

In many hydrogeologic settings, flow boundary and time-of-travel criteria can be mapped by geological, geophysical, and dye tracing methods. The flow boundaries are defined by lithologic variation or permeability contrasts within the aquifer. Geological observations may provide surface indications of lithology changes, which will correlate with ground water protection area

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

boundaries. Detailed hydrogeologic mapping may also include mapping of ground water levels in order to identify ground water drainage divides.

This method for delineating ground water zones within a protection area may be particularly useful for shallow aquifers, and for fractured rock aquifers.

Figure 6-9 is a conceptual example of ground water zones in fractured bedrock.

### **Numeric Flow/Transport Models**

Ground water protection areas and zones can be delineated using computer models that approximate ground water flow and/or solute transport equations numerically. A wide variety of numerical models are presently available both commercially and through various organizations.

Numeric flow/transport models are particularly useful for delineating protection areas where boundary and hydrogeologic conditions are complex. Input data may include such hydrogeologic parameters as permeability, porosity, specific yield, saturated thickness, recharge rates, aquifer geometry, and the locations of hydrologic boundaries. Solute transport parameters such as dispersivity may also be incorporated in these models.

To be accurate, these models require site-specific field verification and adjustment.

### **6.2.4 Selecting A Ground Water Delineation Method**

Zones within a protection area should be delineated using the times-of-travel specified in Section 6.2.5. The preferred delineation method is one that utilizes the most detailed information available, although a simpler approach may be appropriate for an initial delineation, with a more detailed evaluation later (e.g., in the voluntary protection program). A simpler approach may result in a larger delineated protection area and zones than might be obtained from a more elaborate approach, given the conservative (i.e., health protective) nature of the simple models.

DHS staff will use simple approaches, due to the number of drinking water sources that need to be assessed. However, DHS believes that the more complex approaches are beneficial where appropriate data are available. Such approaches give the most site-specific information, and may preclude the initiation of protection activities beyond those that are needed for protection of a specific ground water source.

Table 6-2 provides guidance on the types of delineation methods that should be used.

### **Porous Media Aquifers**

As a general approach, DHS will use the calculated fixed radius method for delineations for assessment purposes. For non-community water systems, DHS may choose to use the arbitrary

*California Drinking Water Source Assessment and Protection Program*

fixed radius method. Where DHS has sufficiently detailed information on the direction of ground water flow, the modified calculated fixed radius method will be used.

### **Fractured Rock Aquifers**

In fractured rock aquifers, the complexity of the flow system does not lend itself to a simple delineation method that accurately reflects the appropriate size, shape and direction of zones. Given the resources and time available to conduct the assessments, DHS recommends the minimum delineation method in fractured rock to be the calculated fixed radius method, increasing the calculated radius of each zone by 50%. The default effective porosity of 0.2 would be used in the equation. Increasing the size of the zones in fractured rock reflects the increased vulnerability of these sources compared to those in porous media aquifers.

### **Wells in Multiple Aquifers**

When a well is located in multiple aquifers, the zones should be delineated using the methods and values that are more conservative (i.e., health protective). If the well is located in multiple porous media aquifers with varying effective porosity or other parameters, the delineation should use the values that produce the larger delineated area. If the well is located in porous media and fractured rock aquifers the delineation should use the fractured rock method.

### **Ground water under the influence of surface water**

For wells that are ground water under the direct influence of surface water (GWUDI), the protection area must include the land area within the watershed boundaries. This is consistent with DHS regulations, because GWUDI wells are considered surface water sources and are subject to surface water treatment regulations. Zones for these sources may be established by ground water methods and/or surface water methods.

For wells that are indirectly under the influence of surface water (e.g. where the source of water is underflow of a surface water body, and the source has not been classified as GWUDI) it is appropriate to include the land area within the watershed boundaries in the protection area. The recharge area, if different than the watershed area, may also be included in the protection area. Zones are to be established using ground water methods. The areas to be assessed should be determined in consultation with DHS.

## **6.2.5 Approach for Defining Ground Water Zones**

All ground water sources need to have a protection area and zones defined. The suggested approach is to define three zones, and an optional fourth zone. See Figure 6-10 for a conceptual illustration of these zones.

If the delineated area for a ground water source encompasses a surface water body (lake, river, stream, creek, wetland, etc.), the delineation should be reviewed in consultation with DHS.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Suggested protection activities for each of the zones are discussed in Part Four, Voluntary Drinking Water Source Protection Programs.

**Well Site Control Zone**

The well site control zone encompasses the area immediately surrounding the well, what most people think of as the "wellhead." The purpose of this zone is to provide protection from vandalism, tampering, or other threats at the well site.

This zone is determined by using a simple radius, (or equivalent area if a different shape, i.e., a square, is desired). DHS recommends a minimum radius of 50 feet for well site control zones for all public water systems in the state.

**Zone A - Microbial/Direct Chemical Contamination Zone**

The purpose of this zone is to protect the drinking water supply from viral, microbial and direct chemical contamination. The zone is defined by the surface area overlying the portion of the aquifer that contributes water to the well within a **two-year time-of-travel**.

The two-year time-of-travel criterion is used because this is the current recommendation of the proposed Ground Water Rule (GWR). Existing research indicates that bacteria and viruses survive less than two years in soil and ground water. Use of this criterion provides consistency with the proposed GWR.

This area provides only a limited time for responding to serious microbiological contamination or chemical spills.

As an example of what the size of this area might be, see Figures 6-11, for the calculated fixed radius method using the two-year time-of-travel, with porosity assumed as 0.2 and varying screened intervals. DHS recommends a minimum radius of 600 feet for all ground water sources of drinking water in porous media aquifers, and 900 feet in fractured rock aquifers. These distances are believed to be sufficiently conservative (i.e., health protective) for protection from microbiological contaminants.

**Zones B5 and B10 - Chemical Contamination Zones**

The purpose of Zones B5 and B10 is to prevent chemical contamination of the water supply, and to protect the drinking water source for the long term. These zones are used to focus attention on possible chemical contamination that may exist around the well.

**Zone B5** encompasses the area between the two- and **five-year time-of-travel**. This zone provides for more response time for chemical spills than Zone A.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Zone B10** encompasses the area between the five- and **ten-year time-of-travel**. The primary purpose of this zone (along with the recharge area) is to encourage decision-makers and planners to recognize long-term aspects of the drinking water source. The ten-year time-of-travel allows for some attenuation or remediation of contaminant sites, or if necessary, time to develop alternate sources of water supply.

Figures 6-12 and 6-13 are examples the sizes of Zones B5 and B10, respectively, determined by the calculated fixed radius method, using five- and ten-year travel times, with porosity assumed as 0.2 and varying screened intervals.

DHS recommends a minimum radius of 1,000 feet for Zone B5, and 1,500 feet for Zone B10 for porous media aquifers, and 1,500 and 2,250 feet, respectively, for fractured rock aquifers.

A more sophisticated delineation method (e.g., as done voluntarily by a public water system) may determine zones that encompass a smaller area than a circle with the minimum radius recommended by DHS. This may be technically appropriate for the source and should be reviewed by DHS.

#### **Buffer Zone—Additional Zone, If Needed**

The purpose of this zone is to provide added protection to drinking water sources. It can be used to delineate a larger setback around special activities that may be potentially contaminating (e.g., landfills or hazardous material disposal sites), and to provide additional information that may be helpful for longer term planning. This area is upgradient from Zone B10 and may include the entire zone of contribution for the well, indirect recharge areas, or locations where the aquifer may be exposed at the surface.

Drinking water sources that choose to utilize a Buffer Zone within the protection area may do so based on activities that occur outside of Zone B10, and the vulnerability of the drinking water source to possible contamination.

Detailed analytical methods may be necessary to determine the appropriate area for the Buffer Zone. Determination of Buffer Zones should be done in consultation with DHS. An assessment of the buffer zone is not required, but may be useful to the water purveyor.

#### **6.2.6 Modification of the Shape and Size of Zones**

Local knowledge and professional judgement may be used to modify the shape and size of the zones to allow for site-specific characteristics, taking into account the DHS minimum requirements. For example, where several wells have overlapping protection areas, it may be appropriate to combine the zones of the individual wells into larger aggregates. The larger combined zone could then be evaluated as a single entity for purposes of subsequent steps in the assessment. Similarly, if narrow areas of land exist between delineated zones of neighboring



*California Drinking Water Source Assessment and Protection Program*

wells, it may be appropriate to merge the zones of the two wells, incorporating the area in between, and evaluate the merged area as a single zone.

### **6.3 Assessment Map**

After the delineation of the protection area and zones has been completed, the locations must be shown on the assessment map. The map must be based on a USGS quadrangle 7.5 minute series topographic map, and must also show the location of the drinking water source.

### **6.4 Boundary Drinking Water Sources**

Several drinking water sources originate beyond California's boundaries (e.g., Colorado River, Klamath River). DHS will work with Region 9 of the US EPA and other states, as appropriate, to obtain information pertinent to source water assessments for drinking water systems that utilize these water bodies. For ground water sources with protection areas or zones that may cross California's boundaries, DHS will also work with US EPA Region 9 and other states to obtain pertinent information.

Where drinking water sources outside of California (e.g., Truckee River) may require information for their source water assessments, DHS will also work with US EPA Region 9 and other states, as appropriate, to provide information.

### **6.5 Tribal Drinking Water Sources**

For drinking water sources on tribal lands, DHS will work with US EPA Region 9 and tribes to provide pertinent information that is needed to complete drinking water source assessments for tribal lands. Where tribal lands occupy protection areas or zones of non-tribal sources of drinking water, DHS will work with US EPA Region 9 and tribes to obtain information that is needed for those specific assessments.

### **6.6 Transmission Facilities from Drinking Water Intake to Treatment Plant**

When a drinking water intake is located at a different site than the treatment plant (if there is one), the untreated water may be conveyed through an aqueduct, canal, pipeline or other transmission facility. There is the possibility that an activity may exist within the vicinity of the transmission facility that could contaminate the water supply. In California, the threat of contamination to the water supply through this means is reviewed in two ways:

1. Water systems using open channel transmission facilities are required to conduct a watershed sanitary survey for the drainage area that contributes to the channels.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

2. Closed transmission facilities (pipelines) are reviewed and evaluated by DHS (or LPAs) during water system inspections (sanitary surveys).

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Table 6-1. Indicators of presence and degree of confinement of aquifers.**

<b>Information Source</b>	<b>Highly Confined</b>	<b>Semiconfined (Leaky)</b>
<i>Geologic</i>		
Geologic maps and cross-sections	Presence of continuous, unfractured, confining strata (clays, glacial till, shale, siltstone).	Evidence of vertical permeability in confining strata (fracture traces, faults, mineralization or oxidation of fractures observed in cores).
Environmental geologic and hydrogeologic maps	See above.	Presence of artificial penetrations (abandoned or producing oil and gas wells, water wells, exploration boreholes).
<i>Hydrologic</i>		
Water level elevation (single well) of potentiometric surface	Above the top of the aquifer (not diagnostic for differentiation of highly and semi-confined aquifers).	Same
Hydraulic head differences between aquifers	Large head difference in water levels measured in wells cased in different aquifers (not diagnostic for differentiation of highly and semiconfined aquifers).	Same
Water level fluctuations (continuous measurement)	Short-lived and diurnal fluctuations in response to changes in barometric pressure, tidal effects, external loading, no response to recharge events.	Similar to highly confined aquifer, but may also exhibit relatively large and rapid response to recharge events because of leakage through discrete points.
Hydrologic measurements in confining strata	No changes in water levels in response to pumping; diurnal but not seasonal water level fluctuations (see above).	Changes in water levels in response to pumping; seasonal water-level fluctuations in response to seasonal variations in precipitation.
Pump test for storativity	Storativity less than 0.001.	Between 0.01 and 0.001 (not diagnostic).
Pump test for leakage	Pump drawdown vs time curve matches analytical solution(s) for highly confined aquifer. Estimated or calculated leakage less than $10^{-3}$ gal/day/ft <sup>2</sup> .	Pump drawdown vs time curve requires use of analytical solution for leaky aquifer. Estimated or calculated leakage $10^{-2}$ to $10^2$ gal/day/ft <sup>2</sup> .
Numerical modeling	Simulation of potentiometric surface possible without estimates of leakage, or required estimates are low (see above).	Simulation of potentiometric surface requires use of large leakage values.
<i>Hydrochemistry</i>		
General water chemistry	Chemical characteristics indicative of long distance from recharge area(region-specific).	Qualifies as confined using other criteria, but chemical characteristics more similar to ground water in recharge zones.
Anthropogenic atmospheric tracers	No detectable tritium or fluorocarbons in ground water.	Detectable concentrations of tritium or fluorocarbons (less than 40 years old).
Isotope chemistry	Carbon-14 dating of water samples indicates age > 500 years.	See above.
Contaminants	No detectable concentrations of potential contaminants identified by inventory of possible contaminating activities.	Qualifies as confined using other criteria, and contaminants detected in aquifer.
Changes in water chemistry over time	Head declines from long-term pumping have not resulted in changes in water chemistry indicators of vertical leakage.	Head declines from long term pumping have resulted in changes in water chemistry indicators of vertical leakage (see above).
Time of travel through confining strata	Time of travel calculations based on measured or estimated values of difference in hydraulic head, porosity and hydraulic conductivity exceed 40 years.	Time of travel through confining strata < 40 years based on calculations or presence of tritium or fluorocarbons.

Source: Handbook Ground Water and Wellhead Protection, EPA, September 1994, Document EPA/625/R-94/001

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

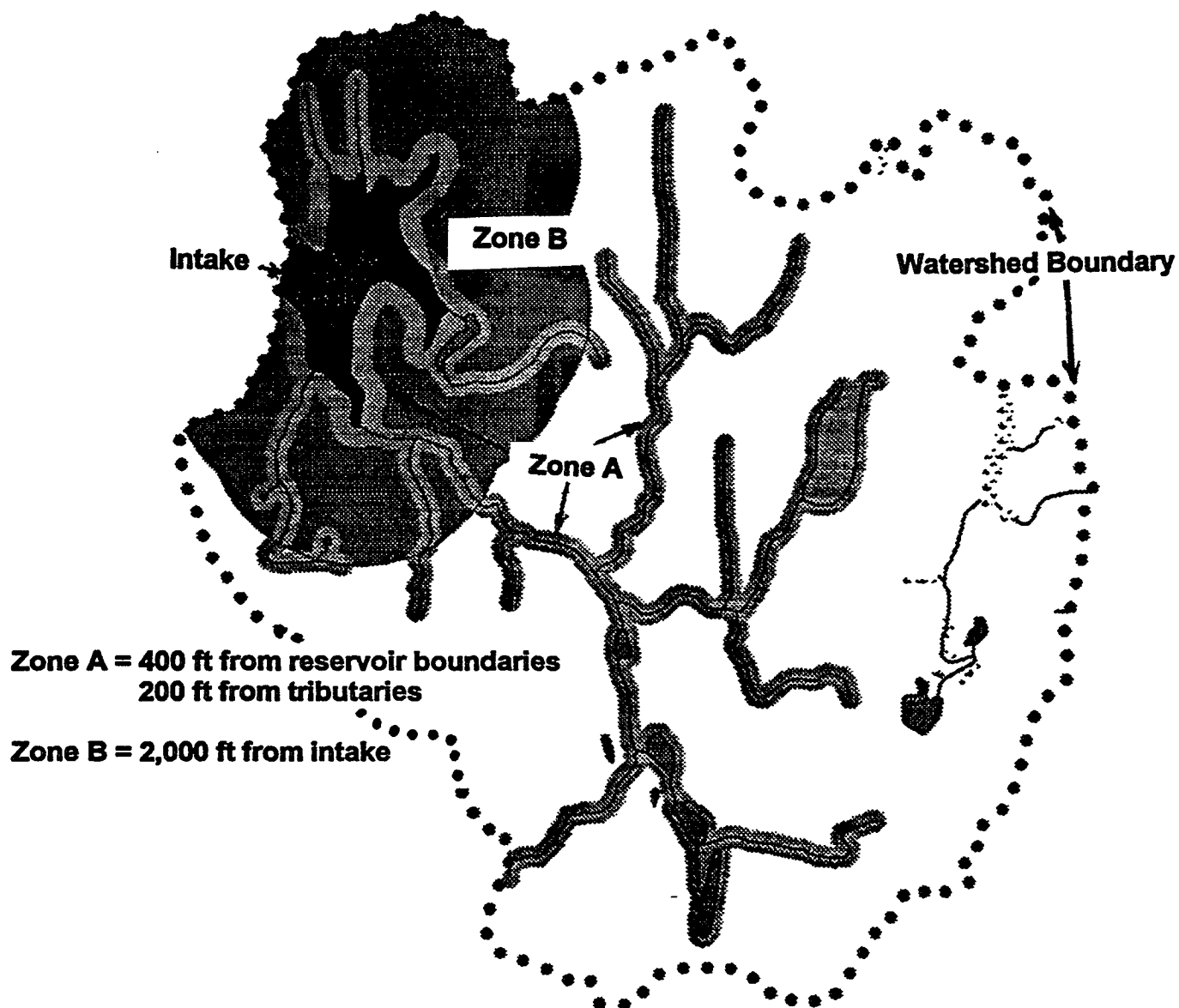
**Table 6-2. Delineation methods, types of system that may use particular methods, minimum data that are required, and the minimum radii of zones.**

<b>Delineation method</b>	<b>Type of system that may use method</b>	<b>Minimum data required</b>	<b>Minimum radius of zone</b>
Arbitrary fixed radius	Non-community	Location of source	A = 600 feet B5 = 1,000 feet B10 = 1,500 feet
Calculated fixed radius (CFR) (porous media)	All*	Location of source, Pumping capacity of well (gpm), Screened interval of well (indicate method used to estimate), Effective porosity (indicate method used to estimate)	A = 600 feet B5 = 1,000 feet B10 = 1,500 feet
CFR (fractured rock)  Note that fractured rock uses CFR and increases size by 50 percent.	All*	Location, Pumping capacity, Screened interval, Effective porosity	A = 900 feet B5 = 1,500 feet B10 = 2,250 feet
Modified CFR	All*	Location, Pumping capacity, Screened interval, Effective porosity, Direction of ground water flow	A = 600 feet B5 = 1,000 feet B10 = 1,500 feet
Analytical methods	All	Location, Capacity, Screened interval, Effective porosity, Hydraulic conductivity, Hydraulic gradient, Direction of ground water flow	No minimums**
Hydrogeologic mapping	All	Hydrogeologic parameters, Lithology, Groundwater level	No minimums**
Numeric flow/transport models	All	Hydrogeologic parameters, Recharge rates, Aquifer geometry, Hydrologic boundaries	No minimums**

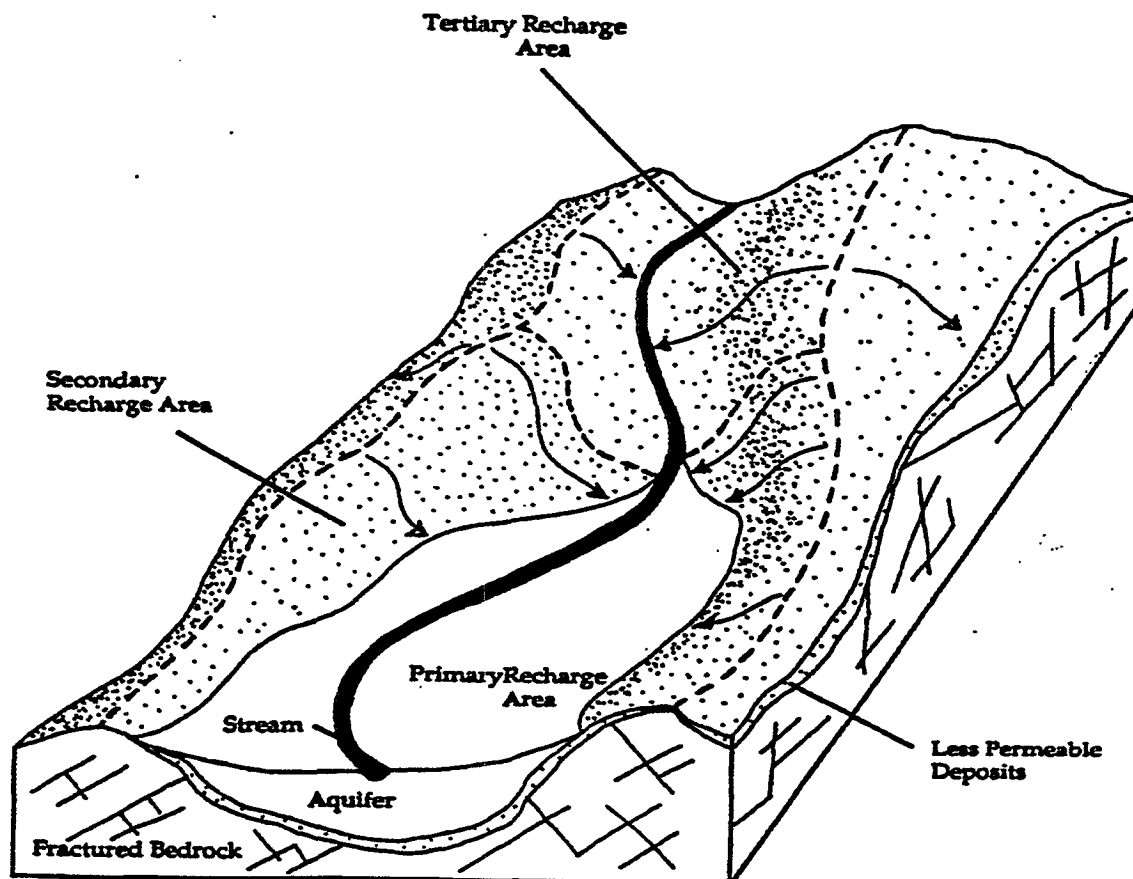
\* Systems with more than 10,000 service connections and with detailed hydrogeologic data are encouraged to conduct more sophisticated analyses.

\*\* Systems using more sophisticated methods are encouraged to compare the sizes of zones to minimum sizes derived by simpler methods to assist in the review of the delineation.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



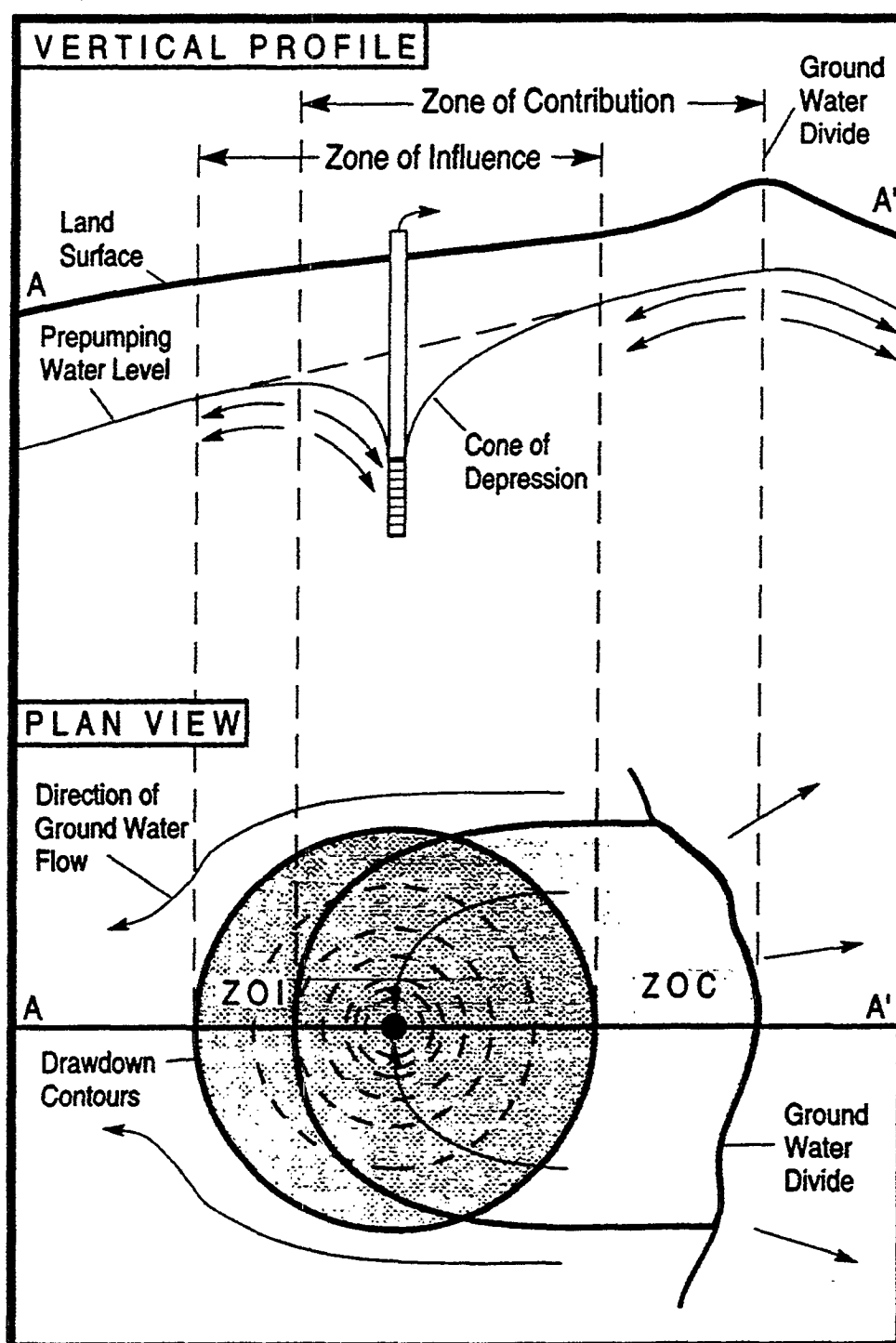
**Figure 6-1. Surface water supply protection areas showing proposed zones (Adapted from Massachusetts DEP "Developing a Local Surface Water Supply Protection Plan," 1996)**



**Figure 6-2. Illustration of recharge areas (Adapted from Witten and Horsley, 1995)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

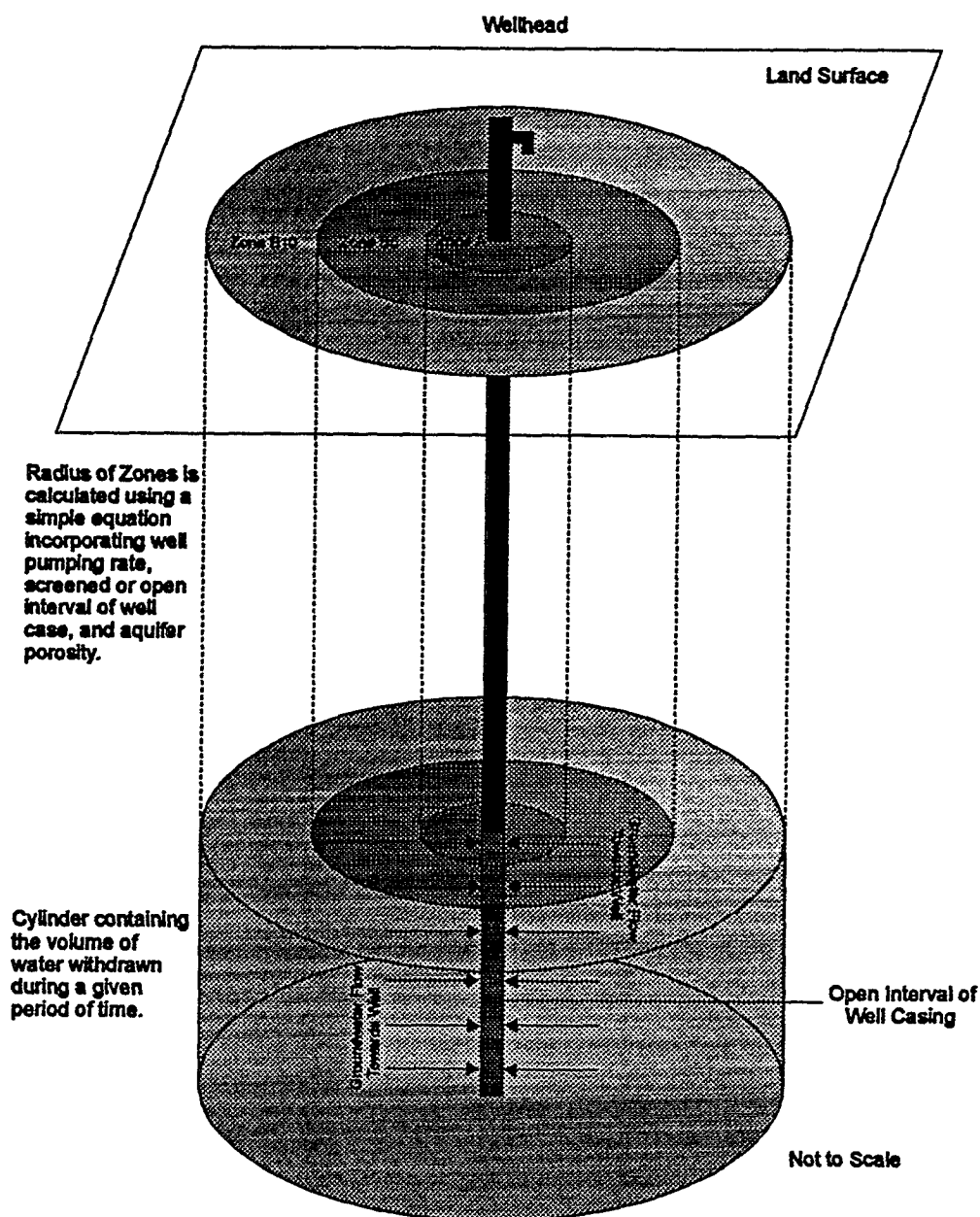
*California Drinking Water Source Assessment and Protection Program*



**Figure 6-3. Changes to the ground water system due to a pumping well (From Witten and Horsley, 1995)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*



$$r = \sqrt{\frac{Q t}{\pi n H}}$$

Where

Q = Pumping Rate of Well

n = Effective Porosity (0.2)

H = Open Interval or Length of Screen

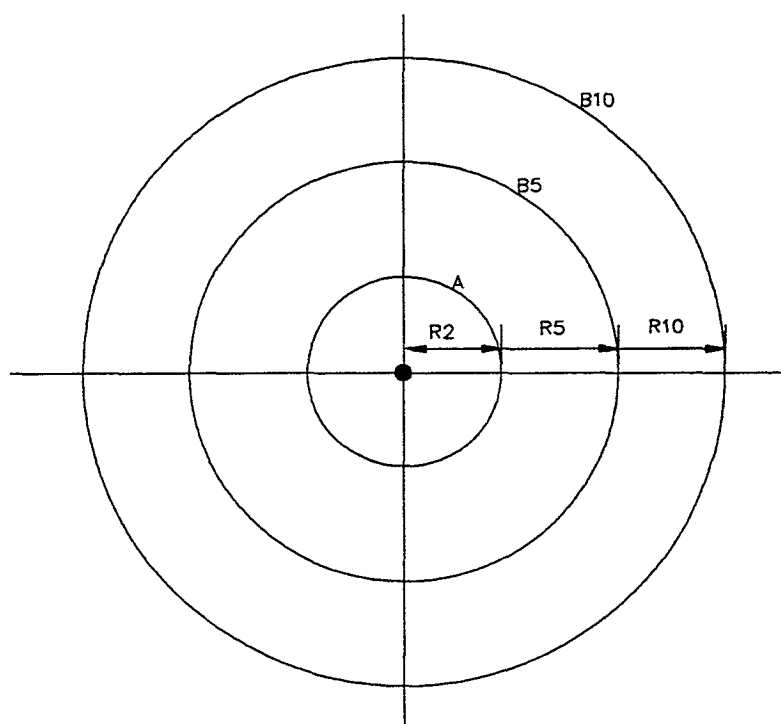
t = Travel Time to Well (2, 5, 10 years)

**Figure 6-4. Calculated fixed radius delineation method** (Adapted from Washington State, "Wellhead Protection Program Guidance Document," 1995)

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

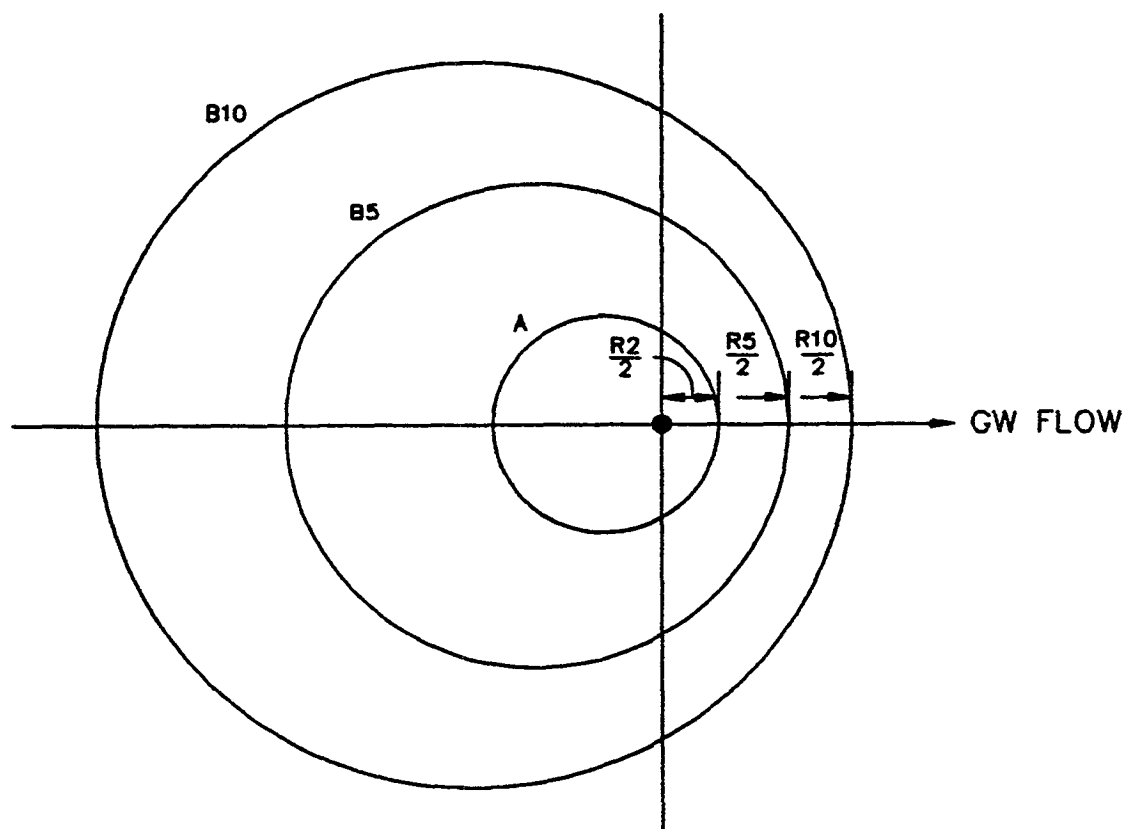



---

**Figure 6-5. Conceptual illustration of the calculated fixed radius method.**

---

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

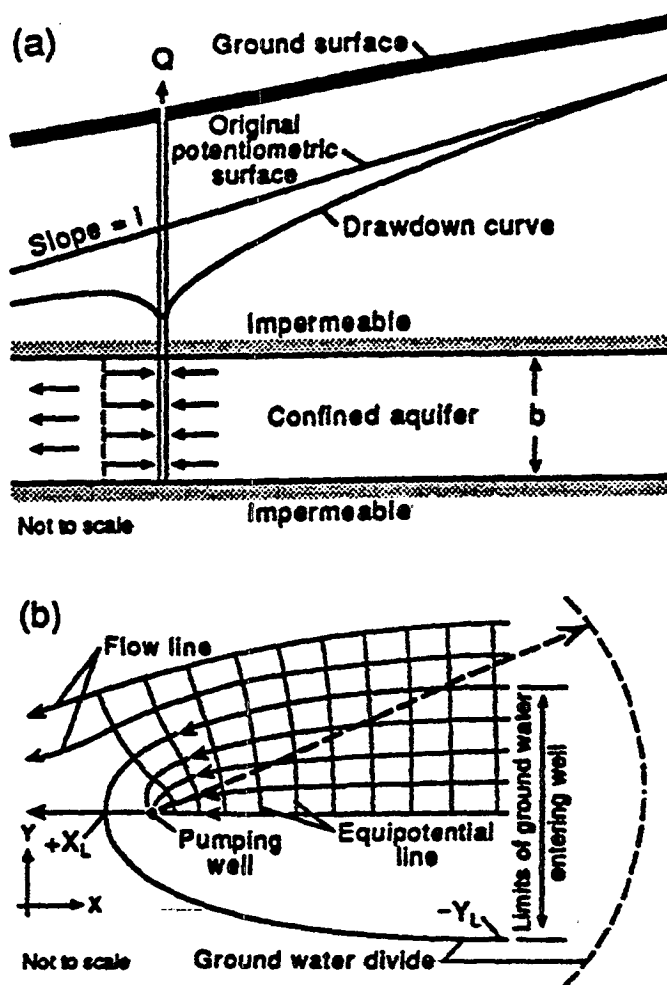



---

**Figure 6-6. Conceptual illustration of the modified calculated fixed radius method.**

---

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



Uniform flow equation:

$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q} Y\right)$$

Distance to down-gradient null point:  $X_L = -\frac{Q}{2\pi Kbi}$

Boundary limit:  $Y_L = \pm \frac{Q}{2Kbi}$

Where:  $Q$  = Well pumping rate  
 $K$  = Hydraulic conductivity  
 $b$  = saturated thickness  
 $i$  = hydraulic gradient  
 $\pi = 3.1416$

**Figure 6-7. Uniform flow equations for determining area of contribution to a pumping well (adapted from Todd, 1980)**



California Drinking Water Source Assessment and Protection Program

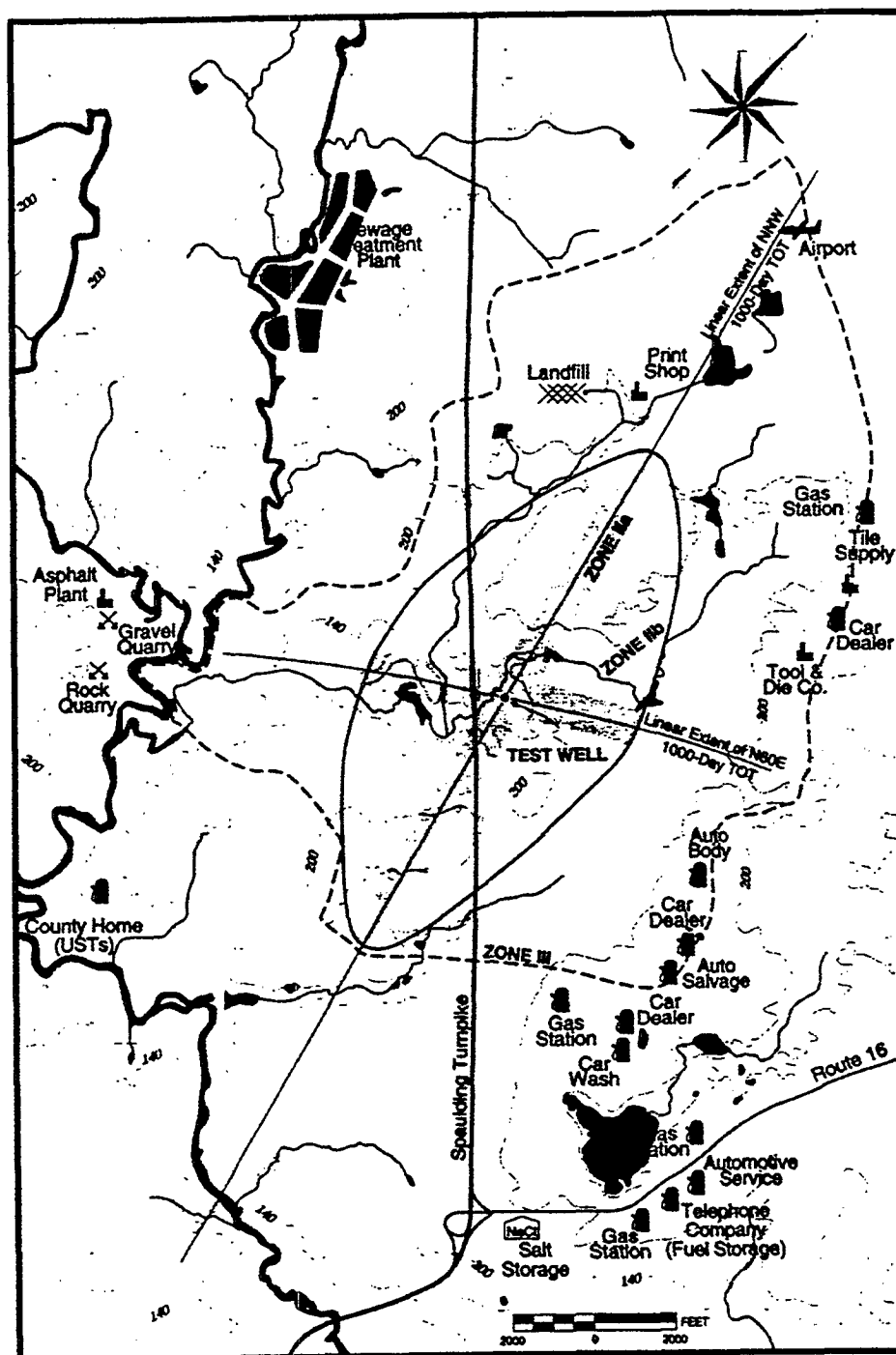
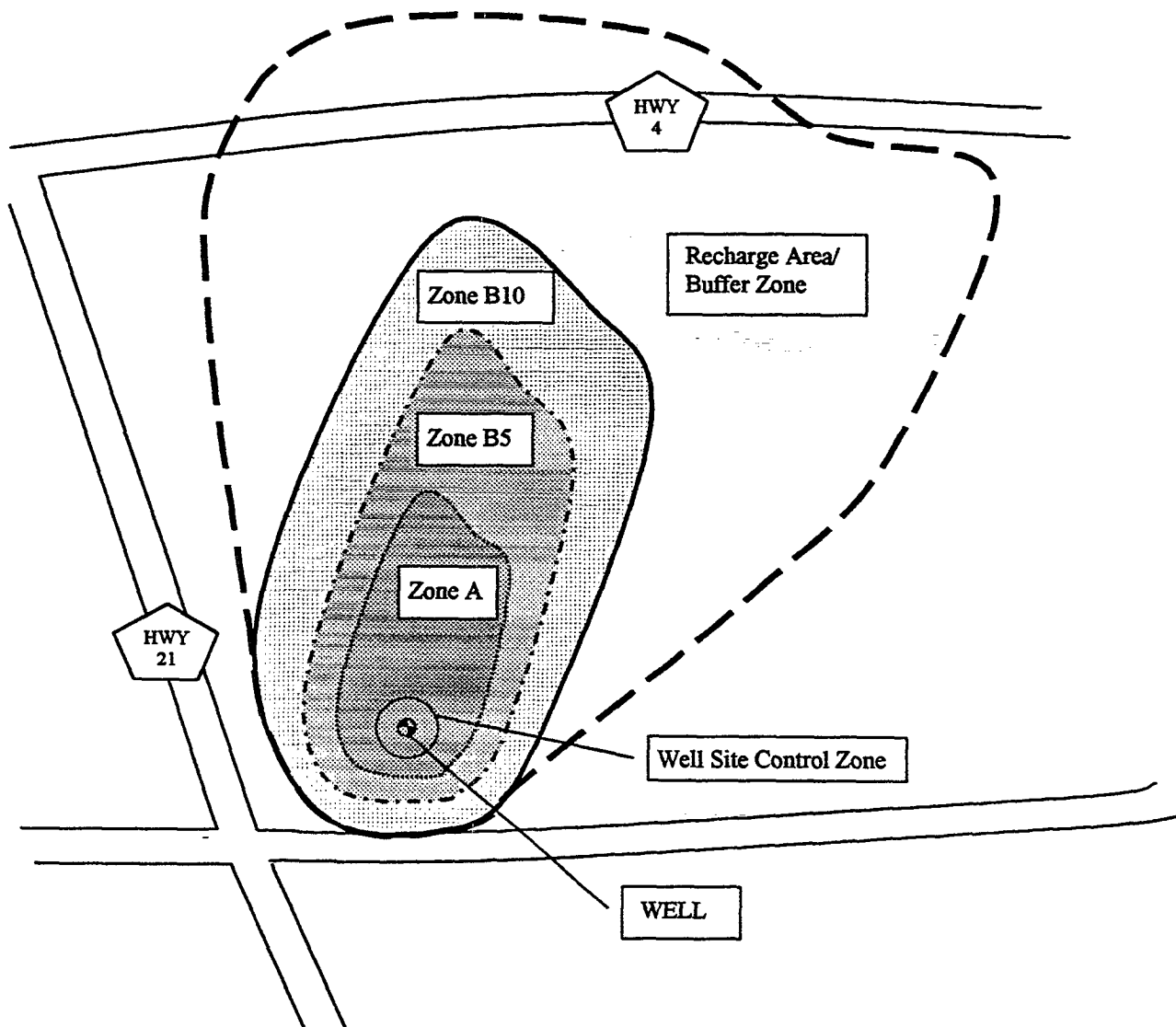


Figure 6-9. Conceptual example for protection area and zones in fractured bedrock (From Witten and Horsley, 1995)

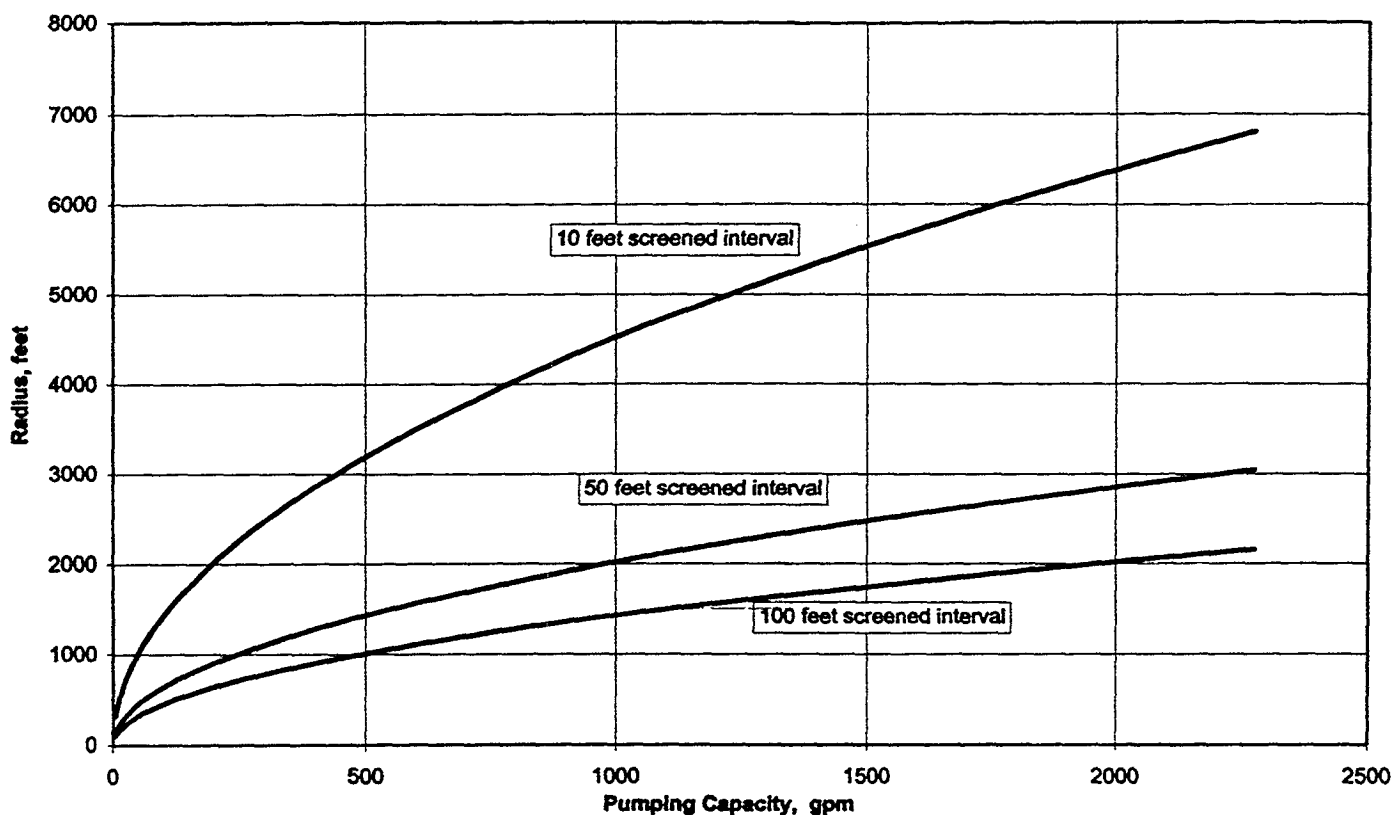
California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*



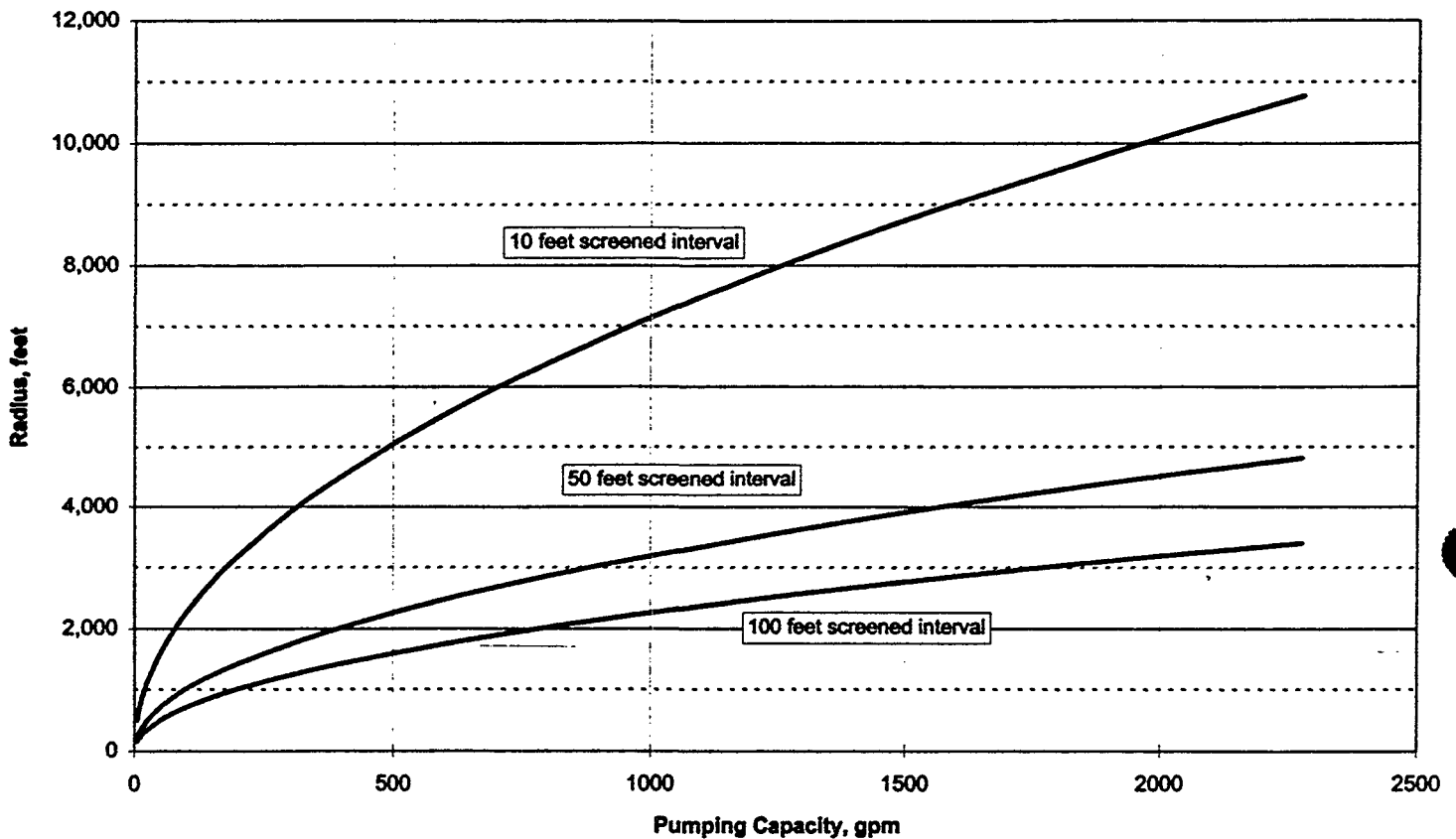
**Figure 6-10. Illustration of conceptual ground water protection area and zones (Adapted from Witten and Horsley, 1995)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Figure 6-11. Radius of microbiological Zone A (2-year time of travel), using calculated fixed radius method (assumes porosity = 0.2)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

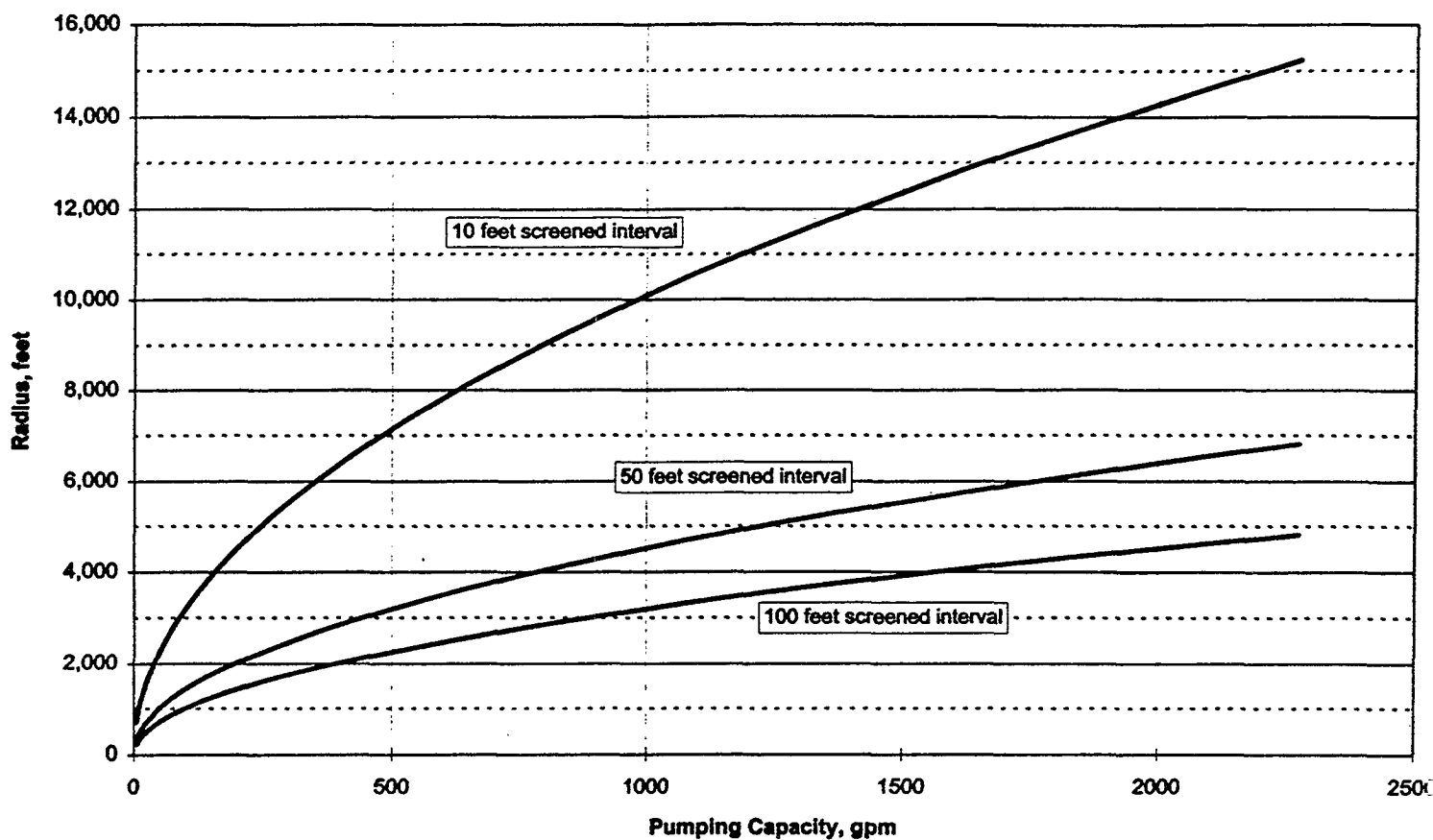
*California Drinking Water Source Assessment and Protection Program*

**Figure 6-12. Radius of microbiological Zone B5 (5-year time of travel), using calculated fixed radius method (assumes porosity =0.2)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*



**Figure 6-13. Radius of microbiological Zone B10 (10-year time of travel), using calculated fixed radius method (assumes porosity =0.2)**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 0 8 6

## **7.0 Inventory of Possible Contaminating Activities (PCAs) within Protection Areas and Zones**

An essential element of the drinking water source assessment program is an inventory of possible contaminating activities, industries, or land use. PCAs are considered to be potential origins of significant contamination in delineated source water protection areas.

An inventory of PCAs can serve at least three important functions:

- Identify past and present activities -- and others that are proposed (to the extent feasible) -- that may pose a threat to the drinking water supply, based on their potential for significant contamination of ground water or surface water. These activities may include transporting, storing, manufacturing, producing, using, or disposing of potential contaminants. Historic activities are also important to include, as are activities that may contribute to a cumulative impact by a potential contaminant that may otherwise be considered somewhat innocuous.
- Provide information on the locations of PCAs, especially those that present the greatest risks to the water supply.
- Provide an effective means of educating the local public about potential problems.

Although there are various steps in developing the PCA inventory, the process should be viewed as an iterative one. If an activity occurs within a zone, it suggests that the activity is a potential origin of significant contamination, and this would be indicated in the initial phases of the drinking water source assessment. Additional review may provide site-specific information that indicates that the activity is not a potential origin of significant contamination. For example, a septic system that is far away from a well may be of less importance than one nearby, in terms of its microbiological significance. A PCA may be important even though it is a great distance away from the source because of the particular contaminant(s) associated with it or other characteristics of the PCA.

The information obtained in the PCA inventory may be helpful in refining the delineation process described in Section 6.0. In addition, iterations of the PCA inventory and delineated protection area are important in voluntary protection programs.

**Contaminants of concern.** If any of the following contaminants of concern are associated with an activity, then that activity needs to be in the PCA inventory.

*California Drinking Water Source Assessment and Protection Program*

- Microorganisms of drinking water importance, including fecal coliform bacteria, *Escherichia coli*, viruses, *Giardia lamblia*, and *Cryptosporidium*.
- Chemicals for which maximum contaminant levels (MCLs) or California drinking water action levels have been established, and unregulated chemicals in drinking water for which monitoring is required (Table 7-1).
- Turbidity and total organic carbon (TOC). Turbidity can affect treatment and monitoring for microbiological contaminants, while TOC can influence the presence of disinfection byproducts, which have an attendant carcinogenic concern.

## **7.1 Information for PCA Inventories**

PCA inventories should be coordinated with requirements of various state, local and federal agencies. Information may be obtained from permitting agencies, such as the state Department of Toxic Substances Control, the Regional Water Quality Control Boards, the Integrated Waste Management Board, the Department of Pesticide Regulation, the Department of Food and Agriculture, or the local air pollution control districts, or other local agencies.

To assist in the PCA inventory process, DHS is preparing a list of agencies that have data available, some of it electronically accessible. This list will include agencies with data on topography, soils, watersheds, drinking water sources, permitted waste dischargers, hazardous waste and other waste sites, leaking underground fuel tanks, pesticide use, and others (see Section 5.0).

DHS will include on its Internet site information that will list agencies and other locations that have or may have pertinent data, and DHS will have Internet links to them when possible. DHS will update and maintain the listing, but will not be responsible for the quality of or for updating the data of other agencies. Accessing this listing and the data other agencies have available could be an initial step in conducting a PCA inventory.

Information from the state-wide data sources will be supplemented with local information: septic systems, land application of biosolids (sewage sludge), livestock operations, wildlife refuges, storm water runoff, recreational bathing beaches, and various hazardous substances data bases maintained by local fire departments, county environmental health departments, and county agricultural commissioners.

## **7.2 Steps in Developing an Inventory of PCAs**

The purpose of the PCA inventory is to identify presence and location of past, present and proposed activities that may pose a threat to the water supply. A PCA represents a location from

*California Drinking Water Source Assessment and Protection Program*

which there is or has been the potential to release contaminants into ground water or surface water at a level of concern. The inventory may also include proposed activities.

The steps involved in a PCA inventory are detailed below.

**7.2.1 Develop an Initial List of PCAs of Concern that May Exist Within or Near the Protection Area**

The initial list of PCAs should include known sources of contamination, significantly high risk activities within or near the recharge area or watershed, and other activities that must not be overlooked in the inventory process. Table 7-2 is a list of activities that may be possibly contaminating.

Before proceeding with the inventory, resources should be assembled that will assist in locating activities; the DHS Internet site data directory, land use maps, files, and contacts for people that may have current and historical knowledge of the area.

**7.2.2 Prepare a PCA Inventory Form**

DHS has developed PCA Inventory Forms for surface water sources (Appendix D) and for ground water sources (Appendix K). The PCA inventory forms presented in the appendices should not be considered complete lists of all potential origins of significant contamination. If a PCA of concern from the initial list (Section 7.2.1) is not on an inventory form, it should be added to the appropriate inventory form. Other forms may be acceptable for the PCA inventory, if reviewed and approved by DHS.

Tables 7-3, 7-4, and 7-5 list activities differentiated by potential risk to a water supply (very high, high, moderate, and low). The lists in those tables provide a means of ranking PCAs for the vulnerability analysis (Section 8.0). The inventory forms (Appendix D for surface water sources and Appendix K for ground water sources) incorporate the information from Tables 7-3, 7-4, and 7-5.

**7.2.3 Conduct the PCA Inventory within the Delineated Protection Area**

The initial review of the PCA inventory may be best performed by an individual or group with knowledge of activities around the drinking water source. The initial review could be done with the Assessment Map (showing drinking water source, protection area and zones) and additional maps that may be available.

The initial review allows those doing the assessment to narrow the PCA inventory lists, eliminating PCAs which do not occur, and noting the locations of PCAs whose existence is known.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

After the initial review, the PCA inventory should be completed using readily available resources. This may include consultation with various government agency or water system staff (especially for historical information), review of maps and files, access to electronic data sources, and field visits.

It is not the intent of the assessment program to identify the exact location of each and every PCA within the protection area and zones. The assessments are intended as a first step in an on-going iterative process. The PCA inventory is intended to identify the types of activities that exist around a drinking water source and the proximity to the source (the zone). A water purveyor may desire to do a more detailed PCA inventory for purposes of a protection program (see Section 11.0). When more detailed information is available it is useful to include this in the assessment.

#### **7.2.4 Indicate PCA Locations on the Assessment Map**

The location of PCAs should be indicated on the Assessment Map (showing drinking water source, protection area and zones). If a water system has a map that more clearly indicates the location of PCAs (e.g., parcel, land use, or service area maps) this may be submitted in addition to the Assessment Map. The Assessment Map may be refined based on additional information obtained from the vulnerability analysis.

Exact locations of PCAs do not have to be shown on the Assessment Map. Rather, the map should indicate the PCAs that exist within each zone. If accurate locations of some PCAs are known, they should be indicated on the map.

A sample map is shown in Figure 7-1.

### **7.3 Names and Addresses Associated with PCAs**

During the development of the DWSAP, DHS received a number of comments on whether or not specific names and addresses of PCAs should be identified in the PCA inventory.

Considerable concern was expressed about labelling a specific business as a "polluter," when in fact inclusion of a PCA only refers to an activity that is "possibly contaminating."

Concern was also expressed about lumping together all types of an activity as one PCA without taking into account whether an individual facility is small or large, or whether it poses an actual risk (based on historical contamination), or a potential risk, based on its specific business operations.

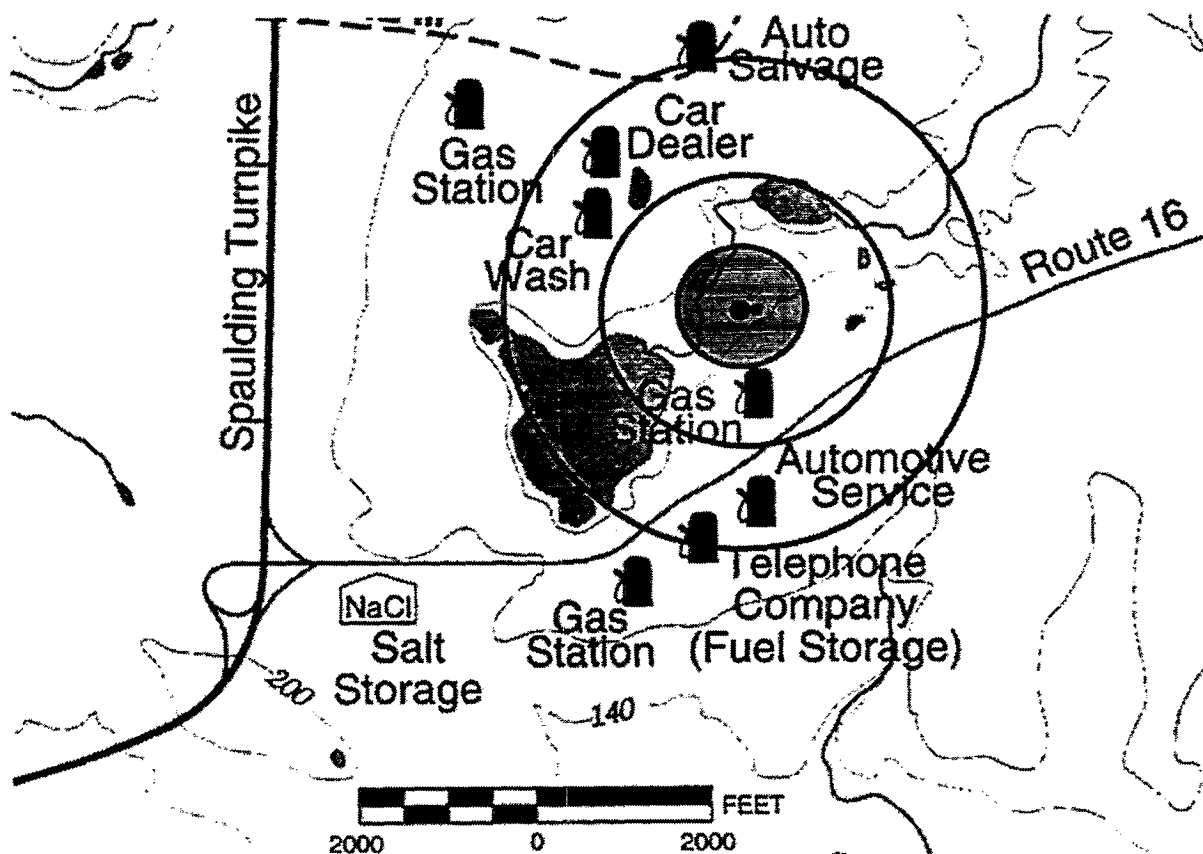
DHS determined that specific identification in terms of name and address is not needed, though the general location of the inventoried PCA needs to be identified on a map. In other words, if a gas station is located within Zone A, B5 or B10 of a well, for source assessment and protection

*California Drinking Water Source Assessment and Protection Program*

purposes, its presence is what is significant. The name of the specific station, who owns it, and its street address are relatively unimportant in terms of the DWSAP.

Information about ownership and other specifics about any property site or business activity can be readily accessed from other public agencies, if it is needed for local protection programs or other reasons.

*California Drinking Water Source Assessment and Protection Program*



**Figure 7-1. Sample map showing ground water source, protection zones (concentric circles), and possible contaminating activities.**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

**Table 7-1. California Drinking Water Primary and Secondary Maximum Contaminant Levels, Action Levels, and Unregulated Chemicals Requiring Monitoring.**

**Maximum Contaminant Levels.** MCLs are primary and secondary drinking water standards. They are enforceable regulatory levels, under the Safe Drinking Water Act, and must be met by all public drinking water systems to which they apply.

**Primary MCLs** are established for 83 chemical and radioactive contaminants. Primary MCLs can be found in Title 22 California Code of Regulations (CCR) for inorganic chemicals (§64431), trihalomethanes (§64439), radioactivity (§64441 and §64443) and organic chemicals (§64444).

**Lead and copper** have specific regulations in 22 CCR, Chapter 17.5 §64670 *et seq.* The lead and copper regulations use the term "action level" for each substance, for purposes of regulatory compliance.

**Secondary MCLs**, which are set for taste, odor, or appearance of drinking water, are presented in 22 CCR §64449. Secondary MCLs exist for 16 chemicals/characteristics.

**Action Levels (ALs).** Except for lead and copper, as described above, ALs are advisory levels for unregulated chemicals, and are not enforceable standards. The ALs that exist for 32 chemicals are listed below. DHS recommends that drinking water utilities provide public notification if ALs are exceeded. If sources exceeding ALs are taken out of service, notification is not needed.

**Unregulated chemicals requiring monitoring.** Some chemicals, (e.g., MTBE) are "unregulated" but have certain monitoring requirements, as set forth in 22 CCR §64450. There are 50 unregulated chemicals that are or may be required to be monitored, depending on the vulnerability of drinking water systems.

**PRIMARY MAXIMUM CONTAMINANT LEVELS**  
[All values in milligrams per liter (mg/L), unless otherwise noted.]

<u>Constituent</u>	<u>Primary MCL</u>
<i>22 CCR §64431, Table 64431-A--Inorganic Chemicals</i>	
Aluminum	1
Antimony	0.006
Arsenic	0.05
Asbestos	7 MFL <sup>a</sup>
Barium	1
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.2
Fluoride	2.0
Mercury	0.002

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Nickel	0.1
Nitrate (as NO <sub>3</sub> )	45
Nitrate + Nitrite (sum as nitrogen)	10
Nitrite (as nitrogen)	1
Selenium	0.05
Thallium	0.002

*22 CCR §64433.2, Table 64433.2-A—Optimal Fluoride Levels*

*See also the Fluoride MCL, 22 CCR §64431, Table 64431-A*

Annual average of maximum daily air temperature	Optimal Level (Range)
50.0 to 53.7 degrees Fahrenheit (°F)	1.2 (1.1–1.7)
53.8 to 58.3 °F	1.1 (1.0–1.6)
58.4 to 63.8 °F	1.0 (0.9–1.5)
63.9 to 70.6 °F	0.9 (0.8–1.4)
70.7 to 79.2 °F	0.8 (0.7–1.3)
79.3 to 90.5 °F	0.7 (0.6–1.2)

*22 CCR §64441 and §64443—Radioactivity*

Gross alpha particle activity <sup>b</sup>	15 pCi/L <sup>c</sup>
Gross beta particle activity	50 pCi/L
Combined Radium-226 and Radium-228	5 pCi/L
Strontium-90	8 pCi/L
Tritium	20,000 pCi/L
Uranium	20 pCi/L

*22 CCR §64439—Total Trihalomethanes*

Sum of bromodichloromethane, dibromochloromethane, bromoform, and chloroform	0.1
--	-----

*22 CCR §64444—Organic Chemicals*

Alachlor (Alanex)	0.002
Atrazine (Aatrex)	0.003
Bentazon (Basagran)	0.018
Benzene	0.001
Benzo(a)pyrene	0.0002
Carbofuran (Furadan)	0.018
Carbon tetrachloride	0.0005
Chlordane	0.0001
2,4-D	0.07
Dalapon	0.2
1,2-Dibromo-3-chloropropane (DBCP)	0.0002
1,2-Dichlorobenzene (o-Dichlorobenzene)	0.6
1,4-Dichlorobenzene (p-DCB)	0.005
1,1-Dichloroethane (1,1-DCA)	0.005
1,2-Dichloroethane (1,2-DCA)	0.0005
1,1-Dichloroethylene (1,1-DCE)	0.006
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
Dichloromethane (Methylene chloride)	0.005
1,2-Dichloropropane (Propylene dichloride)	0.005
Di(2-ethylhexyl)adipate	0.4
1,3-Dichloropropene	0.0005
Di(2-ethylhexyl)phthalate (DEHP)	0.004

*California Department of Health Services*

*Division of Drinking Water and Environmental Management*

*August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Dinoseb	0.007
Diquat	0.02
Endrin	0.002
Endothal	0.1
Ethylbenzene (Phenylethane)	0.7
Ethylene dibromide (EDB)	0.00005
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor epoxide	0.00001
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane (gamma-BHC)	0.0002
Methoxychlor	0.04
Molinate (Ordam)	0.02
Monochlorobenzene (Chlorobenzene)	0.07
Oxamyl	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated biphenyls (PCBs)	0.0005
Simazine (Princep)	0.004
Styrene (Vinylbenzene)	0.1
2,4,5-TP (Silvex)	0.05
2,3,7,8-TCDD (Dioxin)	0.00000003
1,1,2,2-Tetrachloroethane	0.001
Tetrachloroethylene (PCE)	0.005
Thiobencarb (Bolero) <sup>d</sup>	0.07
Toluene (Methylbenzene)	0.15
Toxaphene	0.003
1,2,4-Trichlorobenzene (Unsym-Trichlorobenzene)	0.07
1,1,1-Trichloroethane (1,1,1-TCA)	0.200
1,1,2-Trichloroethane (1,1,2-TCA)	0.005
Trichloroethylene (TCE)	0.005
Trichlorofluoromethane (Freon 11)	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2
Vinyl chloride	0.0005
Xylenes (single isomer or sum of isomers)	1.750

<sup>a</sup> MFL = million fibers per liter, MCL is for fibers exceeding 10 microns in length.

<sup>b</sup> Including radium-226 but excluding radon and uranium.

<sup>c</sup> pCi/L = picocuries per liter.

<sup>d</sup> Also listed with a Secondary MCL of 0.001 mg/L.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**LEAD AND COPPER, 22 CCR §64672.3**

**[All values in milligrams per liter (mg/L).]**

<u>Constituent</u>	<u>Action Level</u>
Copper (Level to be met at customer tap)	1.3 <sup>e</sup>
Lead (Level to be met at customer tap)	0.015 <sup>e</sup>

<sup>e</sup>The action levels for copper and lead are used to determine the treatment requirements that a water system is required to complete. The action level for copper is exceeded if the concentration of copper in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with 22 CCR §64682-§64685 is greater than 1.3 mg/L. Similarly, the action level for lead is exceeded if the concentration of lead in more than 10 percent of tap water samples collected in accordance with 22 CCR §64682-§64685 is greater than 0.015 mg/L. Failure to comply with the applicable requirements for lead and copper (22 CCR Chapter 17.5) is a violation of primary drinking water standards for these substances.

**SECONDARY MAXIMUM CONTAMINANT LEVELS, 22 CCR §64449**

**[All values in milligrams per liter (mg/L), unless otherwise noted.]**

**CONSUMER ACCEPTANCE LIMITS**

<u>Constituent</u>	<u>Secondary MCL</u>
Aluminum	0.2
Color	15 units
Copper	1.0
Corrosivity	Non-corrosive
Foaming agents (MBAS)	0.5
Iron	0.3
Manganese	0.05
Odor-Threshold	3 units
Silver	0.1
Thiobencarb (Bolero) <sup>f</sup>	0.001
Turbidity	5 units
Zinc	5.0

<sup>f</sup> Also listed with a Primary MCL of 0.07 mg/L.

<u>Constituent</u>	<u>Recommended</u>	<u>Secondary MCL Ranges</u>	<u>Short Term</u>
Total Dissolved Solids	500	Upper 1,000	1,500
or			
Specific Conductance, micromhos	900	1,600	2,200
Chloride	250	500	600
Sulfate	250	500	600

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**ACTION LEVELS**  
[All values in milligrams per liter (mg/L).]

<u>Constituent</u>	<u>Action Level</u>
<i>Inorganic Chemicals</i>	
Boron	1
Perchlorate	0.018
<i>Organic Chemicals</i>	
Aldicarb (Temik) <sup>g</sup>	0.01
Aldrin <sup>g</sup>	0.00005
Baygon	0.090
a-Benzene Hexachloride (a-BHC)	0.0007
b-Benzene Hexachloride (b-BHC)	0.0003
n-Butylbenzene (1-Butylpropane) <sup>g</sup>	0.045
Captan	0.350
Carbaryl (Sevin) <sup>g</sup>	0.060
Chloropicrin	0.050(0.037) <sup>h</sup>
2-Chlorotoluene (o-Chlorotoluene) <sup>g</sup>	0.045
4-Chlorotoluene (p-chlorotoluene) <sup>g</sup>	0.045
Diazinon (Basudin, Neocidol)	0.014
1,2-Dichlorobenzene (o-Dichlorobenzene)	0.130(0.010) <sup>i</sup>
1,3-Dichlorobenzene (m-Dichlorobenzene)	0.130(0.020) <sup>i</sup>
Dichlorodifluoromethane (Difluorodichloromethane) <sup>g</sup>	1.0
Dieldrin <sup>g</sup>	0.00005
1,4-Dioxane	0.003
Dimethoate (Cygon) <sup>g</sup>	0.140
2,4-Dimethylphenol	0.40
Diphenamide	0.040
Ethion	0.035
Formaldehyde	0.030
Isopropyl N (3-Chlorophenyl) Carbamate (CIPC)	0.350
Malathion	0.160
Methyl Isobutyl Ketone (MIBK)	0.040
Methyl Parathion	0.030
Methyl-tert-butyl ether (MTBE) <sup>g</sup>	0.035
N-Nitrosodimethylamine (NDMA)	0.000002
Parathion	0.030
Pentachloronitrobenzene (Terrachlor)	0.0009
Phenol	0.0050 <sup>j</sup>
Trithion	0.0070

<sup>g</sup> Chemical is identified as "unregulated" for purposes of monitoring.

<sup>h</sup> Taste and odor threshold.

<sup>i</sup> Taste and odor threshold either for a single isomer or the sum of the two isomers.

<sup>j</sup> Taste and odor threshold for chlorinated systems.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**UNREGULATED CHEMICALS REQUIRING MONITORING, 22 CCR §64450**

Monitoring is required for chemicals designated "a". If a system is determined to be vulnerable, monitoring is required for chemicals designated "b" and "c".

<u>Constituent</u>	<u>Unregulated category</u>
<i>Organic Chemicals</i>	
Aldicarb (Temik) <sup>k</sup>	c
Aldicarb sulfone	c
Aldicarb sulfoxide	c
Aldrin <sup>k</sup>	c
Bromacil (Hyvar X, Hyvar XL)	b
Bromobenzene (Monobromobenzene)	a
Bromochloromethane (Chlorobromomethane)	b
Bromodichloromethane (Dichlorobromomethane)	a
Bromoform (Tribromomethane)	a
Bromomethane (Methyl bromide)	a
Butachlor (Butanex, Lambast, Machete)	c
n-Butylbenzene (1-Butylpropane) <sup>k</sup>	b
sec-Butylbenzene (2-Phenylbutane)	b
tert-Butylbenzene (2-Methyl-2-phenylpropane)	b
Carbaryl (Sevin) <sup>k</sup>	c
Chlorodibromomethane (Dibromochloromethane)	a
Chloroethane (Ethyl chloride)	a
Chloroform (Trichloromethane)	a
Chloromethane (Methyl chloride)	a
Chlorothalonil (Bravo)	b
2-Chlorotoluene (o-Chlorotoluene) <sup>k</sup>	a
4-Chlorotoluene (p-chlorotoluene) <sup>k</sup>	a
Dibromochloromethane (Chlorodibromomethane)	a
Dibromomethane (Methylene bromide)	a
Dicamba (Banax, Banvel, Dianat)	c
1,3-Dichlorobenzene (m-Dichlorobenzene) <sup>k</sup>	a
Dichlorodifluoromethane (Difluorodichloromethane)	a
1,3-Dichloropropane	a
2,2-Dichloropropane	a
1,1-Dichloropropene	a
Dieldrin <sup>1</sup>	c
Dimethoate (Cygon) <sup>k</sup>	b
Diuron (Karmex, Krovar)	b
Hexachlorobutadiene (Perchlorobutadiene)	b
3-Hydroxycarbofuran	c
Isopropylbenzene (Cumene)	b
p-Isopropyltoluene (p-Cymene)	b
Methoxychlor (Lannate)	c
Methyl-tert-butyl ether (MTBE) <sup>k</sup>	b
Metolachlor (Metelilachlor)	c
Metribuzin (Lexone, Sencor, Sencoral)	c
Naphthalene (Naphthalin)	b
1-Phenylpropane (n-Propylbenzene)	b
Prometryn (Caparol)	b

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Propachlor (Albrass, Ramrod)	c
1,1,1,2-Tetrachloroethane	a
1,2,3-Trichlorobenzene (vic-Trichlorobenzene)	b
1,2,3-Trichloropropane (Allyl Trichloride)	a
1,2,4-Trimethylbenzene (Pseudocumene)	b
1,3,5-Trimethylbenzene (Mesitylene)	b

<sup>k</sup> Chemical also has a California drinking water action level.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Table 7-2. Potential sources of surface and ground water contaminants.**

Potential Sources of Surface and Ground Water Contaminants	
Source	Groundwater Contaminants <sup>1,2,3</sup>
<b><u>Commercial / Industrial</u></b>	
Automobile	
Body shops/repair shops	Waste oils; solvents; acids; paints; automotive wastes; <sup>4</sup> miscellaneous cutting oils
Car washes	Soaps; detergents, waxes; miscellaneous chemicals
Gas stations/sumps	Oils; solvents; miscellaneous wastes
Boat Services/repair/refinishing	Diesel fuels; oil; septage from boat waste disposal area; wood preservative and treatment chemicals; paints; waxes; varnishes; automotive wastes <sup>4</sup>
Cement/concrete plants	Diesel fuels; solvents; oils; miscellaneous wastes
Chemical/petroleum processing/storage	Hazardous chemicals; solvents; hydrocarbons; heavy metals; asphalt
Dry cleaners	Solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
Electrical/electronic manufacturing	Cyanides; metal sludges; caustic (chromic acid); solvents; oils; alkalis; acids; paints and paint sludges; calcium fluoride sludges; methylene chloride; perchloroethylene; trichloroethane; acetone; methanol; toluene; PCBs
Fleet/trucking/bus terminals	Waste oil; solvents; gasoline and diesel fuel from vehicles and storage tanks; fuel oil; other automotive wastes <sup>4</sup>
Food processing	Nitrates; salts; phosphorus; miscellaneous food wastes; chlorine; ammonia; ethylene glycol
Funeral services/graveyards	Formaldehyde; wetting agents; fumigants; solvents; leachate; lawn and garden maintenance chemicals <sup>5</sup>
Furniture repair/manufacturing	Paints; solvents; degreasing and solvent recovery sludges; lacquers; sealants
Hardware/lumber/parts stores	Hazardous chemical products in inventories; heating oil and fork lift fuel from storage tanks; wood-staining and treating products such as creosote; paints; thinners; lacquers; varnishes
Home manufacturing	Solvents; paints; glues and other adhesives; waste insulation; lacquers; tars; sealants; epoxy wastes; miscellaneous chemical wastes
Junk/scrap/salvage yards	Automotive wastes <sup>4</sup> ; PCB contaminated wastes; any wastes from businesses <sup>6</sup> and households <sup>7</sup> ; oils; lead
Machine shops	Solvents; metals; miscellaneous organics; sludges; oily metal shavings; lubricant and cutting oils; degreasers (tetrachloroethylene); metal marking fluids; mold-release agents
Medical/vet offices	X-ray developers and fixers <sup>8</sup> ; infectious wastes; radiological wastes; biological wastes; disinfectants; asbestos; beryllium; dental acids; miscellaneous chemicals
Metal plating/finishing/ fabricating	Sodium and hydrogen cyanide; metallic salts; hydrochloric acid; sulfuric acid; chromic acid; boric acid; paint wastes; heavy metals; plating wastes; oils; solvents
Mines/gravel pits	Mine spills or tailings that often contain metals; acids; highly corrosive mineralized waters; metal sulfides; metals; acids; minerals sulfides; other hazardous and nonhazardous chemicals <sup>9</sup>

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

Office buildings/complexes	Building wastes <sup>5</sup> ; lawn and garden maintenance chemicals <sup>5</sup> ; gasoline; motor oil
Parking lots/malls (> 50 spaces)	Hydrocarbons; heavy metals; building wastes <sup>5</sup>
Photo processing/printing	Biosludges; silver sludges; cyanides; miscellaneous sludges; solvents; inks; dyes; oils; photographic chemicals
Plastics/synthetics producers	Solvents; oils; miscellaneous organic and inorganics (phenols, resins); paint wastes; cyanides; acids; alkalis; wastewater treatment sludges; cellulose esters; surfactant; glycols; phenols; formaldehyde; peroxides; etc.
Research laboratories	X-ray developers and fixers <sup>5</sup> ; infectious wastes; radiological wastes; biological wastes, disinfectants; asbestos; beryllium; solvents; infectious materials; drugs; disinfectants; (quaternary ammonia, hexachlorophene, peroxides, chlornexade, bleach); miscellaneous chemicals
Recreational vehicle (RV)/mini storage	Automobile wastes <sup>4</sup> ; gasoline and diesel fuel from vehicles and storage tanks
Sewer lines	Sewage
Wood preserving/treating	Wood preservatives; creosote, pentachlorophenol, arsenic
Wood/pulp/paper processing and mills	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals <sup>9</sup> ; organic sludges; sodium hydroxide; chlorine; hypochlorite; chlorine dioxide; hydrogen peroxide; treated wood residue (copper quinolate, mercury, sodium bazide); tanner gas; paint sludges; solvents; creosote; coating and gluing wastes
<b><u>Agricultural/Rural</u></b>	
Auction lots	Livestock sewage wastes; nitrates; phosphates; coliform and noncoliform bacteria; giardia, viruses; total dissolved solids
Chicken/turkeys	Nitrates; phosphates; potassium; total dissolved solids; salts
Confined animal feeding operations	Livestock sewage wastes; nitrates; phosphates; chloride; chemical sprays and dips for controlling insect, bacterial, viral and fungal pests on livestock; coliform <sup>10</sup> and noncoliform bacteria; viruses; giardia; total dissolved solids
Dairies	Livestock sewage wastes; nitrates; total dissolved solids; salts; phosphates; potassium.
Farm chemical distributor/application service	Pesticides <sup>11</sup> ; fertilizers <sup>12</sup> ; hydrocarbons from motor vehicles and storage tanks
Farm machinery repair	Automotive wastes <sup>4</sup> ; welding wastes
Irrigated crops	Pesticides <sup>11</sup> ; fertilizers <sup>12</sup> ; nitrates; phosphates; potassium (can be worsened by over-watering)
Lagoons	Nitrates; Livestock sewage wastes; salts; pesticides <sup>11</sup> ; fertilizers <sup>17</sup> ; bacteria
Nonirrigated crops	Pesticides <sup>11</sup> ; fertilizers <sup>12</sup> ; nitrates; phosphates; potassium
Pesticide/fertilizer/petroleum storage & transfer areas	Pesticides <sup>11</sup> ; fertilizers <sup>12</sup> ; petroleum residues
Rural homesteads	<b>Machine shops:</b> Automotive wastes <sup>4</sup> ; welding wastes; solvents; metals; lubricants; sludges <b>Septic systems:</b> Septage; coliform <sup>10</sup> and noncoliform bacteria; viruses; nitrates; heavy metals; synthetic detergents; cooking and motor oils; bleach; pesticides <sup>5,13</sup> paints; paint thinner; photographic chemicals; swimming pool chemicals; <sup>14</sup> septic tank/cesspool cleaner chemicals; <sup>15</sup> elevated levels of chloride, sulfate, calcium, magnesium, potassium, and phosphate
Sludge application to land	Organic and inorganic chemicals, coliform and noncoliform bacteria, viruses

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

Swine	Nitrates; phosphates; potassium
<b><u>Residential / Municipal</u></b> Airports (maintenance/fueling areas)	Jet fuels; deicers; diesel fuel; chlorinated solvents; automotive wastes; <sup>4</sup> heating oil; building wastes <sup>6</sup>
Apartments and condominiums	Swimming pool maintenance chemicals <sup>14</sup> ; pesticides for lawn and garden maintenance and cockroach, termite, ant, rodent, and other pest control <sup>5,13</sup> ; wastes from on-site sewage treatment plants; household hazardous wastes <sup>7</sup>
Camp grounds/RV parks	Septage; gasoline; diesel fuel from boats; pesticides for controlling mosquitoes, ants, ticks, gypsy moths, and other pests <sup>11,13</sup> ; household hazardous wastes from RVs <sup>7</sup>
Drinking water treatment plants	Treatment chemicals; pesticides <sup>11</sup>
Fire stations	General building wastes <sup>6</sup> ; hydrocarbons from test burn areas
Golf courses	Fertilizers <sup>12</sup> ; herbicides <sup>11</sup> ; pesticides for controlling mosquitoes, ticks, ants, gypsy moths, and other pests <sup>5</sup>
Housing	<p><b>Household hazardous wastes:</b> Household cleaners; oven cleaners; drain cleaners; toilet cleaners; disinfectants; metal polishes; jewelry cleaners; shoe polishes; synthetic detergents; bleach; laundry soil and stain removers; spot removers and dry cleaning fluid; solvents; lye or caustic soda; household pesticides;<sup>13</sup> photo chemical; printing ink, paints; varnishes; stains; dyes; wood preservatives (creosote); paint and lacquer thinners; paint and varnish removers and deglossers; paint brush cleaners; floor and furniture strippers</p> <p><b>Mechanical Repair and Other Maintenance Products:</b> Automotive wastes;<sup>4</sup> waste oils; diesel fuel; kerosene; #2 heating oil; grease; degreasers for driveways and garages; metal degreasers; asphalt and roofing tar; tar removers; lubricants; rustproofers; car wash detergents; car waxes and polishes; rock salt; refrigerants</p> <p><b>Lawn/garden care:</b> Fertilizers;<sup>11</sup> herbicides and other pesticides used for lawn and garden maintenance<sup>5</sup> (can be worsened by over-watering)</p> <p><b>Swimming pools:</b> Swimming pool maintenance chemicals<sup>14</sup></p> <p><b>Urban runoff/stormwater<sup>3</sup>:</b> Gasoline; oil; other petroleum products; microbiological contaminants</p>
Landfills/dumps	Leachate; organic and inorganic chemical contaminants; waste from households <sup>7</sup> and businesses <sup>6</sup> ; nitrates; oils; metals; solvents; sludge
Motor pools	Automotive wastes <sup>4</sup> ; solvents; waste oils; hydrocarbons from storage tanks
Parks	Fertilizers <sup>12</sup> ; herbicides <sup>5</sup> ; insecticides <sup>11,13</sup> ; (can be worsened by over-watering)
Railroad yards/maintenance/fueling areas	Diesel fuel; herbicides for rights-of-way <sup>11</sup> ; creosote for preserving wood ties; solvents; paints; waste oils
Recreational use of surface water sources (body contact)	Microbiological contamination from swimmers
Recreational use of surface water sources (motorized watercraft)	Gasoline fuel from watercraft; marinas.
Schools	Machinery/vehicle serving wastes; gasoline and heating oil from storage tanks; general building wastes <sup>6</sup> ; pesticides <sup>11,13</sup> .

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

Septic systems	Septage; coliform <sup>10</sup> and noncoliform bacteria; viruses; nitrates; heavy metals; synthetic detergents; cooking and motor oils; bleach; pesticides; <sup>5,13</sup> paints; paint thinner; photographic chemicals; swimming pool chemicals; <sup>14</sup> septic tank/cesspool cleaner chemicals <sup>15</sup> ; elevated levels of chloride, sulfate, calcium, magnesium, potassium, and phosphate; other household hazardous wastes <sup>7</sup> ;
Sewer lines	Sewage
Utility stations/maintenance areas	PCBs from transformers and capacitors; oils; solvents; sludges; acid solution; metal plating solutions (chromium, nickel, cadmium); herbicides from utility rights-of-way
Waste transfer/recycling stations	Residential and commercial solid waste residues
Wastewater	Municipal wastewater; sludge <sup>16</sup> ; treatment chemicals <sup>17</sup> ; nitrates; heavy metals; coliform <sup>10</sup> and noncoliform bacteria; nonhazardous wastes <sup>16</sup>
<b>Other</b>	
Above ground storage tanks	Heating oil; diesel fuel; gasoline; other chemicals
Construction/demolition areas (plumbing, heating, and air conditioning, painting, paper hanging, decorating, drywall and plastering, acoustical insulation, carpentry, flooring, roofing, and sheet metal etc.)	Solvents; asbestos; paints; glues and other adhesives; waste insulation; lacquers; tars; sealants; epoxy waste; miscellaneous chemical wastes
Historic gas stations	Diesel fuel; gasoline; kerosene
Historic waste dumps/landfills	Leachate; organic and inorganic chemicals; waste from households <sup>7</sup> ; and businesses <sup>6</sup> ; nitrates; oils; heavy metals; solvents
Hospitals	Various chemical and radiological substances, and microorganisms.
Injection wells/drywells/sumps	Stormwater runoff <sup>3</sup> ; spilled liquids; used oils; antifreeze; gasoline; solvents; other petroleum products; pesticides <sup>11</sup> ; and a wide variety of other substances
Managed forests	Pesticides; fertilizers; total dissolved solids
Medical/dental offices and clinics	Various chemical substances.
Military installations	Wide variety of hazardous and nonhazardous wastes depending on the nature of the facility and operation <sup>3,9</sup> ; diesel fuels; jet fuels; solvents; paints; waste oils; heavy metals; radioactive wastes
Seawater intrusion	Salinity, disinfection byproducts
Silviculture	Pesticides, fertilizers, total dissolved solids
Surface water - stream/lakes/rivers	(Directly related to surface water quality in the stream, lake, or river which is recharging groundwater)
Transportation corridors	Herbicides in highway right-of-way <sup>11,5</sup> ; road salt (sodium and calcium chloride); road salt, anticaking additives (ferric ferrocyanide, sodium ferrocyanide); road salt anticorrosives (phosphate and chromate); automotive wastes <sup>4</sup>
Underground storage tanks	Diesel fuel; gasoline; heating oil; other chemical and petroleum products
Veterinary offices/clinics	Various chemical and radiological substances and microorganisms.
Wells, agricultural (such as irrigation wells, abandoned wells)	Storm water runoff, irrigation water runoff, nitrates, pesticides, and other substances
Wells, gas, oil, geothermal	Various petroleum-related substances, inorganics
Wells (such as water supply wells, monitoring wells, unsealed or abandoned wells, and test holes)	Storm water runoff <sup>3</sup> ; solvents; nitrates; septic tanks; hydrocarbons; and other substances

*California Drinking Water Source Assessment and Protection Program*

SOURCE: Adapted from EPA (1993), and from the Oregon Wellhead Protection Program

<sup>1</sup>In general, source water contamination stems from the *misuse and improper disposal* of liquid and solid wastes; the *illegal dumping or abandonment* of household, commercial, or industrial chemicals; the *accidental spilling* of chemicals from trucks, railways, aircraft, handling facilities, and storage tanks; or the *improper siting, design, construction, operation, or maintenance* of agricultural, residential, municipal, commercial, and industrial drinking water wells and liquid and solid waste disposal facilities. Contaminants also can stem from *atmospheric pollutants*, such as airborne sulfur and nitrogen compounds, which are created by smoke, flue dust, aerosols, and automobile emissions, and which are removed from the atmosphere by wet or dry deposition, and runoff from or percolate through the soil. ***When the sources listed in this table are used and managed properly, contamination is not likely to occur, or are likely to occur at low levels.***

<sup>2</sup>Contaminants can reach groundwater from activities occurring on the land surface, such as industrial waste storage; from sources below the land surface but above the water table, such as septic systems; from structures beneath the water table, such as wells; or from contaminated recharge water.

<sup>3</sup>This table lists the most common wastes, but not all potential wastes. For example, it is not possible to list all potential contaminants contained in stormwater runoff or from military installations.

<sup>4</sup>Automobile wastes can include gasoline; antifreeze; automatic transmission fluid; battery acid; engine and radiator flushes; engine and metal degreasers; hydraulic (brake) fluid; and motor oils.

<sup>5</sup>Common pesticides used for lawn and garden maintenance (i.e., weed killers, and mite, grub, and aphid controls) include such chemicals as 2,4-D; chlorpyrifos; diazinon; benomyl; captan; dicofol; and methoxychlor.

<sup>6</sup>Common wastes from public and commercial buildings include automotive wastes; and residues from cleaning products that may contain chemicals such as xylenols, glycol esters, isopropanol, 1,1,1,-trichloroethane, sulfonates, chlorinated phenols, and cresols.

<sup>7</sup>Household hazardous wastes are common household products that contain a variety of toxic or hazardous components.

<sup>8</sup>X-ray developers and fixers may contain reclaimable silver, glutaldehyde, hydroquinone, potassium bromide, sodium sulfite, sodium carbonate, thiosulfates, and potassium alum.

<sup>9</sup>The Resource Conservation and Recovery Act (RCRA) defines a hazardous waste as a solid waste that may cause an increase in mortality or serious illness or pose a substantial threat to human health and the environment when improperly treated, stored, transported, disposed of, or otherwise managed. A waste is hazardous if it exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity. Not covered by RCRA regulations are domestic sewage; irrigation waters or industrial discharges allowed by the Clean Water Act; certain nuclear and mining wastes; household wastes; agricultural wastes (excluding some pesticides); and small quantity hazardous wastes (i.e., less than 220 pounds per month) generated by businesses.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

<sup>10</sup>Coliform bacteria can indicate the presence of pathogenic (disease-causing) microorganisms that may be transmitted in human feces. Diseases such as typhoid fever, hepatitis, diarrhea, and dysentery can result from sewage contamination of water supplies.

<sup>11</sup>Pesticides include herbicides, insecticides, rodenticides, fungicides and avicides. EPA has registered approximately 50,000 different pesticide products for use in the United States. Many are highly toxic and quite mobile in the subsurface. An EPA survey found that the most common pesticides found in drinking water wells were DCPA (dacthal) and atrazine, which EPA classifies as *moderately toxic* (class 3) and *slightly toxic* (class 4) materials, respectively

<sup>12</sup>The EPA National Pesticides Survey found that the use of fertilizers correlates to nitrate contamination of groundwater supplies.

<sup>13</sup>Common household pesticides for controlling pests such as ants, termites, bees, wasps, flies, cockroaches, silverfish, mites, ticks, fleas, worm, rates, and mice can contain active ingredients include naphthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons, arsenic, strychnine, kerosene, nitrosamines, and dioxin.

<sup>14</sup>Swimming pool chemicals can contain free and combined chlorine; bromine; iodine; mercury-based, copper-based, and quaternary algaecides; cyanuric acid; calcium or sodium hypochlorite; muriatic acid; sodium carbonate.

<sup>15</sup>Septic tank/cesspool cleaners include synthetic organic chemicals such as 1,1,1 trichloroethane, tetrachloroethylene, carbon tetrachloride, and methylene chloride.

<sup>16</sup>Municipal wastewater treatment sludge can contain organic matter, nitrates; inorganic salts, heavy metals; coliform and noncoliform bacteria; and viruses.

<sup>17</sup>Municipal wastewater treatment chemicals include calcium oxide; alum; activated alum, carbon, and silica; polymers; ion exchange resins; sodium hydroxide; chlorine; ozone; and corrosion inhibitors.

*California Drinking Water Source Assessment and Protection Program*

**Table 7-3. Possible Contaminating Activities (PCAs) associated with Very High potential risks.** Very High risk PCAs are considered to have the highest potential for drinking water contamination, greater than those designated High risk (Table 7-4), Moderate risk (Table 7-5), or Low risk (Table 7-6). The risk rankings are based on the general nature of activities and the contaminants associated with them (refer to Table 7-2), not on facility-specific management practices. Instead, such management practices may be considered in the vulnerability analysis, and should be considered in a protection program. (An asterisk [\*] indicates PCAs that may be associated with microbiological contamination.)

**COMMERCIAL/INDUSTRIAL**

Automobile-related activities

- Gas stations

Chemical/petroleum processing/storage

Dry cleaners

Metal plating/ finishing/fabricating

Plastics/synthetics producers

**RESIDENTIAL/MUNICIPAL**

Airports - maintenance/fueling areas

Landfills/dumps

\*Septic systems - High density (>1/acre)  
(VH if in Zone A, otherwise M)

\*Wastewater Treatment Plants (VH in Zone A, otherwise H)

**AGRICULTURAL/RURAL**

\*Confined Animal Feeding Operations

(CAFOs) (VH in Zone A, otherwise H)

- Auction lots (>50 head/acre)
- Beef Cattle (>50 head/acre)
- Chicken/turkeys (>200/facility)
- Dairy cattle (>50 head/acre)
- Sheep (>50 head/acre)
- Swine (>50 head/acre)
- Other animal facilities

**OTHER**

Underground injection of commercial/  
industrial discharges

Historic gas stations

Historic waste dumps/landfills

Injection wells/dry wells/sumps

Military installations

Mining operations

- Historic
- Active

Underground storage tanks

- Confirmed leaking tanks

*California Drinking Water Source Assessment and Protection Program*

**Table 7-4. Possible Contaminating Activities (PCAs) associated with High potential risks.** High risk PCAs are considered to have less potential for drinking water contamination than those designated Very High risk (Table 7-3), but greater potential for contamination than those designated Moderate risk (Table 7-5), or Low risk (Table 7-6). The risk rankings are based on the general nature of activities and the contaminants associated with them (refer to Table 7-2), not on facility-specific management practices. Instead, such management practices may be considered in the vulnerability analysis, and should be considered in a protection program. (An asterisk [\*] indicates PCAs that may be associated with microbiological contamination.)

**COMMERCIAL/INDUSTRIAL**

Automobile related Activities

- Body shops
- Repair shops

Boat services/repair/refinishing

Chemical/petroleum pipelines

Electrical/electronic manufacturing

Fleet/trucking/bus terminals

Furniture repair/manufacturing

Home manufacturing

Junk/scrap/salvage yards

Machine shops

Photo processing/printing

Research laboratories

Wood preserving/treating

Wood/pulp/paper processing and mills

\*Sewer lines (H, if in Zone A, otherwise L)

**RESIDENTIAL/MUNICIPAL**

Railroad yards/maintenance/fueling areas

\*Sewer lines (H, if in Zone A, otherwise L)

Utility stations - maintenance areas

\*Wastewater Treatment Plants (VH in Zone A, otherwise H)

**AGRICULTURAL/RURAL**

\*Confined Animal Feeding Operations

(CAFOs) (VH in Zone A, otherwise H)

- Auction lots (>50 head/acre)
- Beef Cattle (>50 head/acre)
- Chicken/turkeys (>200/facility)
- Dairy cattle (>50 head/acre)
- Sheep (>50 head/acre)
- Swine (>50 head/acre)
- Other animal facilities

Farm chemical distributor/ application service

Farm machinery repair

Residential parcels > 1 acre:

- Machine shops
- \*Septic systems (H if in Zone A, otherwise L)

\*Lagoons/liquid wastes

Pesticide/fertilizer/petroleum storage and transfer areas

Agricultural/irrigation wells

**OTHER**

NPDES permitted discharges

Illegal activities/unauthorized dumping

Mining – Sand/Gravel

Wells- Oil, Gas, Geothermal

Known contaminant plumes

Salt water intrusion

\*Recreational area - surface water source

Underground storage tanks:

- Non-regulated tanks (tanks smaller than regulatory limit)
- Not yet upgraded or registered tanks

**Table 7-5. Possible Contaminating Activities (PCAs) associated with Moderate potential risks.** Moderate risk PCAs are considered to have a lower potential for drinking water contamination than those designated Very High risk (Table 7-3) and High risk (Table 7-4), and a greater potential for drinking water contamination than activities designated Low risk (Table 7-6). The risk rankings are based on the general nature of activities and the contaminants associated with them (refer to Table 7-2), not on facility-specific management practices. Instead, such management practices may be considered in the vulnerability analysis, and should be considered in a protection program. (An asterisk [\*] indicates activities that may be associated with microbiological contamination.)

#### **COMMERCIAL/INDUSTRIAL**

Car washes  
 Parking lots/malls (>50 spaces)  
 Cement/concrete plants  
 \*Food processing  
 Funeral services/graveyards  
 Hardware/lumber/parts stores

#### **RESIDENTIAL/MUNICIPAL**

\*Septic systems - High density (>1/acre)  
 (VH if in Zone A, otherwise M)  
 Drinking water treatment plants  
 Golf courses  
 Housing - High density (>1 house/0.5 acres)  
 Motor pools  
 Parks  
 Waste transfer/recycling stations

#### **AGRICULTURAL/RURAL**

Crops, irrigated (berries, hops, mint, orchards, sod, greenhouses, vineyards, nurseries, vegetables)  
 NOTE: Drip-irrigated crops are considered Low risks.  
 \*Sewage sludge (biosolids) land application  
 Fertilizer, pesticide/herbicide application without resource management

#### **OTHER**

Above ground storage tanks  
 Wells – water supply, monitoring, test holes  
 Construction/demolition staging areas  
 Contractor or government agency equipment storage yards  
 Managed forests  
 Transportation corridors  
 - Freeways/state highways  
 - Railroads  
 - Historic railroad right-of-ways  
 - Road right-of-ways (herbicide use areas)  
 Hospitals  
 Storm drain discharge points  
 Storm water detention facilities  
 Artificial recharge projects – non-potable water (includes recycled, storm, and untreated imported water)  
 - Injection wells  
 - Spreading basins



**Table 7-6. Possible Contaminating Activities (PCAs) associated with Low potential risks.** Low risk PCAs are considered to have a lower potential for drinking water contamination than those designated Very High risk (Table 7-3), High risk (Table 7-4) or Moderate risk (Table 7-5). The risk rankings are based on the general nature of activities and the contaminants associated with them (refer to Table 7-2), not on facility-specific management practices. Instead, such management practices may be considered in the vulnerability analysis, and should be considered in a protection program. (An asterisk [\*] indicates PCAs that may be associated with microbiological contamination.)

#### **COMMERCIAL/INDUSTRIAL**

\*Sewer lines (H, if in Zone A, otherwise L)  
Appliance/Electronic repair  
Office buildings/complexes  
Rental yards  
RV/mini storage

#### **RESIDENTIAL/MUNICIPAL**

\*Sewer lines (H, if in Zone A, otherwise L)  
Apartments and condominiums  
Campgrounds  
Fire stations  
RV parks  
Schools

#### **AGRICULTURAL/RURAL**

Crops, non-irrigated (e.g. Christmas trees, grains, grass seeds, hay)  
Residential parcels > 1 acre:  
- \* Septic systems (H if in Zone A, otherwise L)  
Fertilizer, pesticide/herbicide application with resource management

#### **OTHER**

Underground storage tanks  
- Decommissioned - inactive  
- Upgraded and/or registered – active  
Roads/Streets  
Artificial recharge projects - potable water  
- Injection wells  
- Spreading basins  
Medical/dental offices/clinics  
Veterinary offices/clinics  
\*Surface water - streams/lakes/rivers

## **8.0 Vulnerability of Drinking Water Sources to Contamination**

After the initial inventory of Possible Contaminating Activities (PCAs) has been completed, each drinking water source will be evaluated to determine its vulnerability to contamination.

The overall approach by DHS is to determine the PCAs to which the drinking water source is most vulnerable. The vulnerability analysis is conducted to determine if there are source and/or site characteristics that may increase or decrease the vulnerability of the source to PCAs within a particular zone. The purpose of the vulnerability analysis is to take the long list of activities identified in the PCA inventory and prioritize them in order to determine which PCAs represent the most significant threat to the water supply. The list of PCAs to which the drinking water source is considered vulnerable will include all PCAs associated with contaminants detected in the water supply.

The vulnerability analysis uses the results of the PCA inventory and a determination of Physical Barrier Effectiveness to develop a prioritized list of PCAs for a drinking water source.

### **8.1 Definition**

**Vulnerability:** Vulnerability is an evaluation to determine the greatest (most significant) threats to the quality of the water supply. The evaluation takes into account the characteristics of the source and site to determine their effectiveness as a physical barrier to contamination. The vulnerability evaluation also considers the type and proximity to the water supply of activities that could release contaminants.

Vulnerability as defined here is consistent with existing California regulations (see Section 8.4).

### **8.2 Vulnerability Analysis Procedures**

A vulnerability analysis for a drinking water supply consists of evaluating the source and site characteristics together with the PCAs identified in the inventory (See Section 7).

Source and site characteristics are used to determine the Physical Barrier Effectiveness (PBE) for the drinking water source. The PBE can be determined using site-specific

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

information on hydrogeology, hydrology and soils. Additional information is required depending upon whether the source is ground water or surface water.

The PCA assessment can be accomplished by using the PCA inventory forms, supplemented if needed with additional local information on contaminant activities.

### **8.2.1 Drinking Water Source and Site Characteristics**

#### **8.2.1.1 Drinking Water Source Information**

Information regarding source and site characteristics is compiled in order to determine the Physical Barrier Effectiveness of the site. Information on the drinking water source should be compiled using readily available data and reports. A minimum level of information is necessary to make the initial determination, and additional information may be useful in refining the determination.

For surface water sources, Appendix C shows the minimum water body and watershed information necessary. Most of this information can be found in the Watershed Sanitary Survey for the source.

For ground water sources, the minimum information necessary to determine Physical Barrier Effectiveness is shown in Appendix J. The information to be collected should be available from well logs, Department of Water Resources maps of ground water basins, soil survey maps, some general knowledge of the hydrogeology of the area, and well operation information.

#### **8.2.1.2 Determination of Physical Barrier Effectiveness**

A qualitative rating of low, moderate or high Physical Barrier Effectiveness (PBE), based on the drinking water source and site characteristics, is assigned to each source. A simple approach to determining PBE for surface water is shown in Appendix C, and for ground water in Appendix J. With this approach, the reviewer collects some basic information on the water body and watershed for surface water, and on the drinking water source and aquifer for ground water. This information is then evaluated with parameters that indicate the relative effectiveness of the source and site in preventing the migration of contaminants to the water supply.

In general, the intent of the Physical Barrier Effectiveness determination is to highlight the sources that have "high" or "low" effectiveness. Most sources will have "moderate" PBE. A more detailed review of the Physical Barrier Effectiveness at a site can be done during the development of a local source water protection program (see Section 11.0).

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program***Surface Water**

For surface water, the PBE evaluation considers several parameters including the size of and detention time in the reservoir, topography, geology, soils, vegetation, precipitation and ground water recharge. The size of the watershed is also important to consider, in terms of its potential for dilution or retardation of contaminants.

As shown in Appendix C, in order to get a high PBE ranking, all the parameters for a source must have values that indicate an effective barrier. For example, a source with a high PBE would be in flat terrain, with low precipitation and non-erosive soils covered by grassland.

A source is considered to have low PBE (i.e. high potential for contamination), if any of the parameters have values that do not indicate an effective barrier. For example, a source would be considered to have a low PBE if the watershed has steep slopes or if the soils are erodible or have high runoff potential.

For surface water, all sources that do not clearly have a low or high PBE are considered to have a moderate PBE. To be conservative (i.e., health protective), if any of the parameters is unknown, the drinking water source is considered to have low physical barrier effectiveness.

**Ground Water**

For ground water, the evaluation of Physical Barrier Effectiveness first considers the degree of confinement of the aquifer. An aquifer could be classified as confined, semi-confined (or leaky), unconfined, or unknown. Detailed review is necessary to determine that an aquifer is confined. Table 6-1 lists indicators to consider in determining the presence or degree of confinement of an aquifer. In general, DHS will assume that an aquifer is unconfined unless detailed hydrogeologic information is available that clearly indicates that the aquifer is confined.

**PBE of Confined Aquifers**

Confined aquifers generally are considered highly effective in preventing the migration of contaminants. However, the PBE may be diminished if abandoned or improperly destroyed wells are present that corrupt the integrity of the confining layer. The PBE may be improved if the hydraulic head in the confined aquifer is higher than the hydraulic head of aquifers above (i.e. the well exists under artesian conditions). The construction of the well can impact the effectiveness in retarding contaminants, particularly the presence of a properly constructed sanitary seal.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

### **PBE of Unconfined Aquifers**

For aquifers that are unconfined, semi-confined or of unknown confinement, the PBE evaluation next considers the soil materials in the aquifer. Wells in fractured rock are always considered to have low PBE due to the high transport velocities that can occur within fractures. Sources that have a thick continuous layer of clay above the water table have more effective barriers, similar to confined aquifers.

Abandoned or improperly destroyed wells within the protection zones for a source can decrease the effectiveness of the barrier. Because of the prevalence of abandoned and improperly destroyed wells, and the difficulty of locating them, they are considered to decrease the effectiveness of all ground water sources unless their absence can be assured.

In unconfined aquifers, water level conditions of a well can impact the likelihood that contaminants may be drawn to the well. Greater depths to ground water are more effective at preventing contamination. Wells with high production rates, short screened intervals and perforations located close to the top of the water table are more likely to pull contaminants towards the well.

As with unconfined aquifers, the construction of the well in a confined aquifer can impact its effectiveness in retarding contaminants, particularly the presence of a properly constructed sanitary seal.

The procedures for determining PBE for ground water use the checklist in Appendix J. A ground water source is assigned points for each parameter on the Physical Barrier Effectiveness checklist. The points are totaled to arrive at a PBE score for the source, ranging from a low of 0 points to a high of 100 points. The PBE points in themselves are not a quantitative value, rather they are used to determine the overall PBE rating for the source: low, moderate or high.

### **Physical Barrier Effectiveness Score Interpretation**

<u>Point Total</u>	<u>PBE</u>
0 to 35	Low (includes all sources in fractured rock)
36 to 70	Moderate
71 to 100	High

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Notes on Physical Barrier Effectiveness checklist for ground water:**

- The highest score a source in a confined aquifer can get is 100 (High PBE). The lowest score a source in a confined aquifer can get is 40 (Moderate PBE).
- The highest score a source in an unconfined aquifer can get is 80 (High PBE). Without having a clay layer 25' thick, the highest score for a source in an unconfined aquifer is 70 (Moderate PBE).
- The only sources that can get High PBE are those in unconfined aquifers with a clay layer, and those in confined aquifers.
- All sources in fractured rock are considered to have Low PBE.

**8.2.2 Modifying the Risk Ranking for a PCA**

As described in Section 7.0, the PCA inventory includes a ranking of the potential risk or threat of contamination to a drinking water source. In that inventory, activities that are considered to have a high potential for drinking water pollution are designated "very high" or "high" risk. Other activities having lower potential for drinking water pollution are designated "moderate" or "low" risk.

The risk ranking provides a simple approach to comparing the relative risk of PCAs. The risk rankings are based on the general nature of the activities and the contaminants associated with them (refer to Table 7-2), not on facility-specific information, such as management practices.

The risk ranking of a PCA may be modified after the initial inventory has been conducted based on local information. For example, a "high" risk PCA that is properly controlled and monitored could be reclassified as a "moderate" or "low" risk. The type of information to be considered in modifying a risk ranking include: the type(s) of contaminants associated with the activity, the volume of the contaminant, the magnitude of the potential health effects of the contaminant, the potential for the contaminant to migrate to drinking water sources, detection of the contaminant in the drinking water supply, and the compliance history of the facility. Appendix E for surface water sources and Appendix L for ground water sources show the procedures to modify the risk ranking of a PCA.

Note, however, that in order to modify the risk ranking for a PCA in the assessment, all of the facilities included in that PCA must be evaluated. For example, to reduce the risk ranking for gas stations from "very high", all gas stations within the assessment area must be evaluated using Appendix E or L, and the risk ranking can only be modified if all the gas stations meet the parameters for a lower risk ranking.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

Modifying the risk ranking of PCAs is an optional part of the drinking water source assessment. Evaluation of site-specific information may best be performed during the development of a local protection program (see Section 11.0).

### **8.2.3 Determination of Vulnerability**

DHS has developed a simple approach to substitute for a detailed vulnerability determination. The vulnerability analysis uses the PCA inventory and the Physical Barrier Effectiveness determination to prioritize the list of PCAs in order to determine which PCAs represent the most significant threat to the water supply.

The vulnerability ranking process is shown in Appendix F for surface water sources and Appendix K for ground water sources. The process involves reviewing each PCA identified in the inventory (and those PCAs whose presence is unknown) and assigning points based on the risk ranking of the PCA, the zone in which it occurs, and the Physical Barrier Effectiveness of the drinking water source. The points are added together, and the PCAs are prioritized according to points from highest to lowest, with the highest points representing the PCAs to which the source is most vulnerable. Finally, a cutoff point is identified, and the source is not considered vulnerable to PCAs with points below the cutoff.

As with the PBE scores, the vulnerability points in and of themselves do not have a quantitative value. Rather, the points are used to rank the PCAs for an individual source. The ranking is intended as a preliminary tool to facilitate local source water protection programs that are site-specific.

The steps in the vulnerability ranking are listed below. The points for each element are shown below, and the process for adding the points and assessing the relative vulnerability is illustrated in the matrices below.

1. For each Possible Contaminating Activity (PCA) identified as existing in the protection area, or unknown, determine number of points for the risk ranking of that PCA.
2. For each PCA determine which zone in which it occurs and add the points associated with that zone. If the PCA exists within more than one zone, repeat the process for each zone.
3. For each drinking water source determine the Physical Barrier Effectiveness (PBE) and add the points associated with that PBE (these points are for Low, Moderate and High PBE as shown below).
4. Prioritize all PCAs by the Vulnerability Points, from the most points to the least.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

5. The drinking water source is vulnerable to all PCAs with Vulnerability Points above the cutoff. Refer to the appropriate Vulnerability Matrix below.
6. In addition, the drinking water source is vulnerable to all PCAs associated with a contaminant detected in the water source, regardless of the Vulnerability Points.
7. The drinking water source is considered vulnerable to PCAs that are Unknown, if the Vulnerability points are equal to or greater than the cutoff. As shown in the matrices below, a source is vulnerable to all Very High risk PCAs if it is unknown whether the PCAs exist.

**Points for Vulnerability Analysis**

**Risk Ranking Points:**

Very High	7
High	5
Moderate	3
Low	1

**Zone Points:**

<u>Surface Water (Zones defined)</u>		<u>Surface Water (Zones not defined)</u>		<u>Ground Water</u>	
Zone A	= 5	Watershed	= 5	Zone A	= 5
Zone B	= 3			Zone B5	= 3
Remainder of Watershed	= 1			Zone B10	= 1
Unknown	= 0	Unknown	= 0	Unknown	= 0

**Physical Barrier Effectiveness points:**

Low	5
Moderate	3
High	1



*California Drinking Water Source Assessment and Protection Program*

**Vulnerability Matrix for SURFACE WATER SOURCES**

The cutoff point for vulnerability is 8. The drinking water source is considered Vulnerable to all PCA's with Vulnerability Score greater than or equal to 8 (shaded boxes).

PCA points	Zone points		PCA + Zone points	PBE Points			Vulnerability Score PCA + Zone + PBE points		
Risk Ranking	Zones Defined	Zones Not Defined		Low	Med	High	PBE Low	PBE Med	PBE High
VH (7)	A (5)	Watershed (5)	12	5	3	1	17	15	13
VH (7)	B (3)		10	5	3	1	15	13	11
VH (7)	Watershed (1)		8	5	3	1	13	11	9
VH (7)	Unknown (0)	Unknown (0)	7	5	3	1	12	10	8
H (5)	A (5)	Watershed (5)	10	5	3	1	15	13	11
H (5)	B (3)		8	5	3	1	13	11	9
H (5)	Watershed (1)		6	5	3	1	11	9	7
H (5)	Unknown (0)	Unknown (0)	5	5	3	1	10	8	6
M (3)	A (5)	Watershed (5)	8	5	3	1	13	11	9
M (3)	B (3)		6	5	3	1	11	9	7
M (3)	Watershed (1)		4	5	3	1	9	7	5
M (3)	Unknown (0)	Unknown (0)	3	5	3	1	8	6	4
L (1)	A (5)	Watershed (5)	6	5	3	1	11	9	7
L (1)	B (3)		4	5	3	1	9	7	5
L (1)	Watershed (1)		2	5	3	1	7	5	1
L (1)	Unknown (0)	Unknown (0)	1	5	3	1	6	4	2

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

**Vulnerability Matrix for GROUND WATER SOURCES**

The cutoff point for vulnerability is 8. The drinking water source is considered Vulnerable to all PCA's with Vulnerability Score greater than or equal to 8 (shaded boxes).

PCA points	Zone points	PCA + Zone points	PBE Points			Vulnerability Score PCA + Zone + PBE points		
Risk Ranking	A, B5, B10		Low	Med	High	PBE Low	PBE Med	PBE High
VH (7)	A (5)	12	5	3	1	17	15	13
VH (7)	B5 (3)	10	5	3	1	15	13	11
VH (7)	B10 (1)	8	5	3	1	13	11	9
VH (7)	Unknown (0) *	7	5	3	1	12	10	8
H (5)	A (5)	10	5	3	1	15	13	11
H (5)	B5 (3)	8	5	3	1	13	11	9
H (5)	B10 (1)	6	5	3	1	11	9	7
H (5)	Unknown (0) *	5	5	3	1	10	8	6
M (3)	A (5)	8	5	3	1	13	11	9
M (3)	B5 (3)	6	5	3	1	11	9	7
M (3)	B10 (1)	4	5	3	1	9	7	5
M (3)	Unknown (0) *	3	5	3	1	8	6	4
L (1)	A (5)	6	5	3	1	11	9	7
L (1)	B5 (3)	4	5	3	1	9	7	5
L (1)	B10 (1)	2	5	3	1	7	5	1
L (1)	Unknown (0) *	1	5	3	1	6	4	2

### **8.3 Uses of Vulnerability Analyses**

The prioritized list from the vulnerability analysis may be used by a water system in developing protection measures to address activities that are most significant to the water supply.

In addition, the prioritized list will be useful to DHS to determine drinking water sources that may be eligible for chemical monitoring relief.

The prioritized list may also be useful on a statewide basis in determining the types of activities that represent the greatest threats to drinking water supplies, their proximity to drinking water sources, and an estimate of their prevalence.

The PBE determination may be useful for a water system in comparing water sources to each other, and identifying the ones that are at greater risk. The PBE determination may be useful on a state-wide basis in determining areas where sources with high or low effectiveness may be concentrated.

### **8.4. Vulnerability Assessment Procedures in California Regulations**

Existing California regulations detail the vulnerability assessment procedures required to obtain a waiver for monitoring certain organic and inorganic chemicals in drinking water supplies.

California Code of Regulations (CCR), Title 22, Chapter 15, Section 64432(l) addresses vulnerability waivers for cyanide:

(l) A water system may be eligible for a waiver from the monitoring frequencies for cyanide specified in paragraph (b)(1) of this section without any prior monitoring if it is able to document that it is not vulnerable to cyanide contamination pursuant to the requirements in section 64445(d)(1) or (d)(2). (*See below*).

CCR, Title 22, Chapter 15, Section 64432.2 addresses vulnerability waivers for asbestos for ground water systems:

The Department will determine the vulnerability of ground water sources on the basis of historical monitoring data and possible influence of serpentine formations.

CCR, Title 22, Chapter 15, Section 64445(d)(1) and (2) addresses waivers for organic chemicals based on use and susceptibility:

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

(d) A water system may apply to the Department for a monitoring waiver for one or more of the organic chemicals on Table 64444-A in accordance with the following:

(1) A source may be eligible for a waiver if it can be documented that the chemical has not been previously used, manufactured, transported, stored, or disposed of within the watershed or zone of influence and therefore, that the source can be designated non-vulnerable.

(2) If previous use of the chemical locally is unknown or the chemical is known to have been used previously and the source cannot be designated non-vulnerable pursuant to Paragraph (d)(1), it may still be eligible for a waiver based on a review related to susceptibility to contamination. The application to the Department for a waiver based on susceptibility shall include the following:

- (A) Previous monitoring results;
- (B) user population characteristics;
- (C) proximity to sources of contamination;
- (D) surrounding land uses;
- (E) degree of protection of the water source;
- (F) environmental persistence and transport of the chemical in water, soil and air;
- (G) elevated nitrate levels at the water supply source; and
- (H) historical system operation and maintenance data including previous Departmental inspection results.

## **9.0 Implementation of the Drinking Water Source Assessment Program**

California is mandated by federal law to fulfill the requirements of the assessment portion of DWSAP Program. However, time and financial resources are not sufficient to enable DHS to perform comprehensive, detailed assessments for this program, though the state will provide guidance, recommendations and technical assistance to water systems that choose to do more detailed assessments on their own.

A completed drinking water source assessment will likely be a requirement for obtaining or continuing chemical monitoring waivers. Existing regulations describe the vulnerability analysis process that is required for waivers (see Section 8.4). Many water suppliers have some kind of monitoring waiver at present, so certain applicable aspects of the assessment program are partially completed.

DHS encourages large systems to do their own source water assessments. Large public water systems with surface water sources should make use of their watershed sanitary surveys to satisfy the requirement for a drinking water source assessment. DHS considers a watershed sanitary survey completed in accordance with existing watershed sanitary survey guidance to satisfy most of the assessment requirements of the DWSAP Program.

Systems that have performed evaluations for their ground water sources (e.g., work done for Assembly Bill 3030 Groundwater Management Plans) may find that, depending on the extent of those evaluations, they may satisfy all or portions of the requirements of the DWSAP Program.

DHS plans to conduct source water assessments for those sources not voluntarily conducted by public water systems or by local primacy agency (LPA) counties. The methods herein describe DHS' approach to carry out the assessments and shall serve as the minimum requirements for source water assessments.

### **9.1 Source Location**

DHS will determine intake locations for surface water sources and wells for ground water sources as accurately as possible, via Global Position System (GPS) during inspections and site visits, preferably using GPS units with a sensitivity (accuracy) of 25 meters or less. DHS may make use of locational data from other sources (i.e., public water systems). For GPS positioning, or in cases in which previous GPS locating has been done, the sensitivity or accuracy of the GPS unit will be recorded.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **9.2 Protection Area and Zone Delineation**

Because of the limitation of resources and time constraints, DHS does not anticipate using the more sophisticated models described in Section 6.0, and instead will use simplified methods. However, drinking water systems that choose to do their own assessments may utilize more complex models, with DHS approval.

For surface water sources, DHS will delineate the entire watershed as a protection area, and will define zones if warranted.

For ground water sources, the overall protection area is comprised of the aquifer and recharge area. Zones within the protection areas will generally be delineated by DHS using the calculated fixed radius method. For non-community water systems DHS may choose to use the arbitrary fixed radius method.

Recharge areas will be identified to the extent that they can be determined from readily available information.

## **9.3 Inventory of PCAs and Vulnerability Analyses**

Details of the PCA inventory and vulnerability analysis were presented in Sections 7.0 and 8.0.

DHS will utilize readily available information related to on-going programs, like those of the Regional Water Quality Control Boards, that have information on wastewater discharges and watershed management, and programs of local agencies and other entities, which have information on hazardous chemical storage, business operations, and the location of septic systems. Some of these data may be accessible electronically, as mentioned in Section 7.0.

## **9.4 Availability of Assessment Results to the Public**

A checklist for a completed source water assessment is presented in Appendix G for a surface water source and Appendix K for a ground water source.

Copies of assessment results (including inventory forms, maps, and other information described in Appendices G and K) will be available for public review in DHS district field offices and are recommended to be available for public review at the office of the public water system. The means of providing results of assessments at other locations will be dictated by the size and complexity of the assessments, and by local interest.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

Water purveyors must inform customers in the annual consumer confidence report when and where assessments are available.

## **9.5 Updating Information**

Assessments should be reviewed and updated every five years. As part of an assessment update, comments may be solicited from local agencies and the public, or others who may have suggestions of additional information that should be included or other possible improvements. Where a local drinking water source protection program has been put in place, DHS anticipates that information from that program would be included in any assessment updates.

## **9.6 Anticipated Schedule for Drinking Water Source Assessments**

As mentioned above, a number of activities required under existing law (e.g., watershed sanitary surveys for surface water sources) are related to surface water and ground water assessment and protection. These activities will proceed and can be incorporated easily into the DWSAP Program.

There are approximately 16,000 active drinking water sources in California (Table 9.1), and several thousand standby and inactive sources. Given the resource limitations (approximately \$7.5 million, from the federal State Revolving Fund if matching funds from the state are obtained, or roughly a few hundred dollars per source), DHS envisions scheduling its assessments according to its normal three- to five-year cycle for water system inspections. Further, since public water systems with surface water sources need to update watershed sanitary surveys on a five-year cycle, that requirement will dictate the schedule for surface water sources. To the extent that public water systems elect to conduct their own assessments, the schedule will be modified (See Section 9.10).

DHS anticipates that drinking water source assessments will be completed throughout the time period 1999-2003 with the following approach over those four years, listed in order of DHS' priority for completing assessments:

1. Community water systems with more than 1,000 up to 10,000 service connections, approximately 660 ground water sources (100 systems) and 50 surface water sources (30 systems) per year.
2. Community water systems with 200 to 1,000 service connections, approximately 280 ground water sources (90 systems) and 30 surface water sources (25 systems) per year.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

3. Community water systems with fewer than 200 service connections, approximately 670 ground water sources (540 systems) and 60 surface water sources (50 systems) per year.
4. Non-community, non-transient water systems, approximately 280 ground water sources (240 systems) and 10 surface water sources (10 systems) per year.
5. Non-community water, transient systems: approximately 980 ground water sources (approximately 940 systems) and 80 surface water sources (80 systems) per year.
6. Community water systems with more than 10,000 service connections, approximately 840 ground water sources (40 systems) and 50 surface water sources (20 systems) per year.

Standby and inactive sources will not be scheduled for a source water assessment during this period, unless they are activated. If activated after April 1, 2003, public water systems will need to complete a source water assessment for standby and inactive sources before they can be used.

New sources will be assessed by the public water systems that intend to bring them on line (see Section 10.0).

DHS intends assessments to be completed by April 2003, in order to meet the federally-required completion deadline.

The overall order of completion of drinking water source assessments would change if some public water systems complete their own assessments, as discussed in the next section.

## **9.7 Assessments Done Voluntarily by Drinking Water Systems**

As mentioned previously, conducting drinking water source assessments is the responsibility of DHS. However, drinking water systems are not precluded from conducting their own, with approval of DHS, and they may voluntarily choose to do so.

A number of public water systems have already performed evaluations that may satisfy many of the requirements of the drinking water assessment. Watershed sanitary surveys, for example, have been mentioned throughout this document as examples of programs required for surface water sources that will largely satisfy the assessment requirements of

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



*California Drinking Water Source Assessment and Protection Program*

the DWSAP program. Some public water systems may have already conducted other similar kinds of evaluations for their ground water sources of drinking water. Those systems should contact the DHS district office to determine whether their prior work or portions of it are sufficient to satisfy the needs of the DWSAP Program.

There are a number of benefits to a drinking water system that has a complete comprehensive assessment of its sources. These include:

- DHS will incorporate the DWSAP approach for assessing susceptibility into its vulnerability determination for monitoring waivers (see Section 7.5). A deadline will be established beyond which any waiver renewals will be subject to the new approach. California may also adopt the soon-to-be proposed federal chemical monitoring reform regulations combined with a Permanent Monitoring Relief Program; in this case, assessments would be required for waivers by federal mandate.
- Source water assessments will be a prerequisite for gaining access to State Revolving Fund monies for local source water protection programs (see Section 11.0).
- DHS will require a comprehensive assessment for any new source that a water system wishes to have permitted (see Section 10.0).
- A drinking water system may be qualified for some relief of regulatory requirements under the anticipated groundwater disinfection rule if it has completed a comprehensive source water assessment.
- For communities interested in source water protection activities, the DWSAP assessments provide the basic information to begin those activities.
- There are many public relations benefits for a drinking water system that has conducted a source water assessment.

The State Revolving Fund moneys available to the State to conduct assessments will provide the equivalent of only a few hundred dollars per source for assessments. To meet the US EPA timeline, assessments done by DHS will be performed expeditiously, in the order listed in Section 9.6.

Based on the history of implementing other drinking water-related programs in California, DHS believes that some systems will proceed with conducting their own source water assessments. An estimate of the possible implementation is as follows:

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Large water systems (>10,000 service connections).** DHS expects that these systems will voluntarily conduct all the elements of a source water assessment, with some data tools provided by DHS and other agencies.

**Medium water systems (>1,000 to 10,000 service connections).** DHS expects that most of these systems will voluntarily conduct some of the elements of a source water assessment (location of drinking water sources, delineation of source protection areas and zones, PCA inventory, dissemination of assessment results to the public). Roughly half of these systems are expected to conduct their vulnerability analyses with technical support by DHS and other agencies. The remainder will be performed by DHS.

**Small water systems (<1,000 service connections).** DHS, LPA counties, and/or other agencies are expected to conduct all of the source water assessments for these systems, using State Revolving Fund monies. Some may be able to conduct their own PCA inventories.

For drinking water systems or communities that want to immediately embark on voluntary source water protection programs (see Section 11.0), incorporation of the source water assessment steps into those programs is appropriate, and is encouraged by DHS.

Public water systems that conduct their own drinking water source assessments will need to submit a progress report to DHS no later than February 2002, and the final assessment to DHS no later than January 1, 2003, to enable departmental review. Those systems intending to incorporate the drinking water source assessment into their scheduled watershed sanitary survey update cycle should inform DHS and indicate when the update will be available (no later than January 1, 2003).

DHS will have to conduct the assessments if they are not completed by public water systems.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Table 9-1. Distribution of California's 15,984 drinking water sources by public drinking water system size and source type.**

System Size, by Service Connections (SCs)	Ground Water		Surface Water	
	Systems	Sources	Systems	Sources
>10,000 SCs	152	3,362	74	165
1,000–10,000 SCs	394	2,656	130	192
200–1,000 SCs	359	1,130	102	134
<200 SCs	2,151	2,689	209	226
Non-Transient	964	1,135	47	48
Transient	3,773	3,929	313	318
Total	7,793*	14,901	875*	1,083
* Some systems have both ground water and surface water sources, and are included in each column. Therefore, the total of 8,668 ground water and surface water systems presented in this table exceeds the actual number of systems.				

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **10.0 New Drinking Water Sources**

DHS will require a water supplier proposing a new drinking water source to delineate a protection area, conduct a contaminant activity inventory, and perform a vulnerability analysis prior to DHS approval and permitting of the new drinking water source. Assessment work that has been done for existing drinking water sources will make this requirement easier to meet.

Any new drinking water source for a public drinking water system must be permitted by DHS prior to use of the source. Each new drinking water source will be required to have a completed assessment as a component of its permit application package. The assessment will be considered in the permitting of the source.

The minimum requirements for a drinking water source assessment, which are presented in Section 3.0, along with other pertinent citations in this document are:

- ✓ **Location of the Drinking Water Source.** Section 9.0 and Appendix A or H.
- ✓ **Delineation of Protection Areas and Zones.** Section 6.0, and Appendix B or I.
- ✓ **Inventory of Possible Contaminating Activities (PCAs).** Section 7.0 and Appendices D and E, or K and L.
- ✓ **Physical Barrier Effectiveness Checklist.** Section 8.0 and Appendix C or J.
- ✓ **Vulnerability Analysis.** Sections 8.0 and Appendix F or M.
- ✓ **Assessment Map.** Section 9.0 and Appendix G or N.
- ✓ **Drinking Water Source Assessment Report.** Section 9.0 and Appendix G or N.
- ✓ **Public Notification.** Section 9.0 and Appendix G or N.

Voluntary protection activities for new sources would be similar to those for existing sources, as discussed in Section 11.0.

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 3 0

## PART FOUR

### Voluntary Drinking Water Source Protection Programs

A description of the approach public water systems and communities may wish to use in developing source water protection programs

Section 11—Implementation of a voluntary source water protection program

Section 12—Management approaches within source water protection areas and zones

Section 13—Contingency planning for drinking water supplies

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



## 11.0 Implementation of A Voluntary Source Water Protection Program

A voluntary drinking water source water protection plan offers a public water system or community an opportunity to expand on work done for drinking water source assessments.

The goal of a local source protection program is to identify, develop and implement local measures that advance the protection of the drinking water supply. A local program should maximize use of existing data and develop more detailed information, drawing on local knowledge.

The following steps are recommended for drinking water systems or communities that choose to implement a voluntary source water protection program.

- Review the State's DWSAP Program
- Establish a local advisory committee
- Review the initial drinking water source assessment and determine if and where to expand and improve it. Activities that may be appropriate include:
  - Gather additional site-specific hydrogeologic information and other relevant data
  - Revise delineations of protection area and zones, if necessary
  - Refine and update contaminant activity inventory
  - Review vulnerability analysis, based on hydrogeologic conditions and nature of specific contaminants
  - Prioritize the contaminant activities that need to be studied more closely based on vulnerability
- Prepare reports and maps
- Develop protection program based on original or revised assessment
- Submit protection program (and revised assessment, if appropriate) to DHS, other agencies, and the public
- Implement protection program and its management approaches
- Conduct contingency planning

The sharing of information is encouraged, especially among drinking water systems or communities with common delineated zones or protection areas, or those that share aquifers or watersheds. DHS recommends that communities and systems with common interests work together on protection programs. The DHS' local offices can provide examples of groups of water systems that have joined together to work on similar projects (e.g., watershed surveys).

Smaller systems, whose zones and protection areas lie within the zones or protection areas of a larger system, may be able to make use of the information developed by the larger system, as well as provide information to the larger system.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

More detail about some of the steps is provided below.

### **11.1 Public Involvement during Development of Source Water Protection Program**

A successful source water protection program requires that drinking water systems or communities involve the public. Such involvement may be through the use of already established local public advisory groups, or through the use of volunteers for aspects of information collection, to name two examples. Representatives from the variety of stakeholder groups presented in Table 4-1 may be appropriate to consider in forming local advisory groups.

### **11.2 Review initial source water assessment and determine whether revisions are appropriate**

The source water assessment for the drinking water source should be reviewed to determine whether it should be updated or revised. Revisions of the assessment, if appropriate, could be made on the delineation, the activity inventory, ranking of activities, or the vulnerability analysis, or a combination of these elements.

#### **Delineation**

Local drinking water systems or communities may decide upon different protection areas or zones than were used in the initial assessment. Protection areas and zones should be delineated as described in Section 6.0.

#### **Contaminant Activity Inventory**

As with the original assessment, gathering supplemental information should be coordinated with the work of various state, local and federal agencies. It should also make use of the permits issued and the enforcement actions taken. Some examples of these are presented in Sections 5.0 and Sections 7.0 of this document. Some communities have inventoried potential sources of significant contamination on a parcel-by-parcel basis, using volunteers from the community.

As part of a local protection program, other potential contaminants associated with particular activities could be considered besides those subject to drinking water regulation (see Section 7.0). Those could include the following: US EPA's priority pollutants; chemicals that are subject to the Toxic Release Inventory; California's list of hazardous substances; chemicals identified as causing cancer or birth defects or other reproductive harm for purposes of California's Safe Drinking Water and Toxic Enforcement Act of 1986 ("Proposition 65"); or chemicals for which permits are issued by the Regional Water Quality Control Board.

*California Drinking Water Source Assessment and Protection Program*

Supplemental inventories could include research of written documents, review of land use data, conducting surveys, and field reconnaissance. Each of these methods is described in more detail below.

Written documents include those maintained by federal, state, and local agencies, such as lists, inventories, records and other items that would identify the following: underground or above ground storage tanks, federal Superfund sites, contamination sites, landfill locations, septic systems, and other state and locally regulated activities. Other documents include telephone directories, business records, property tax records, news articles, and historical or archival information.

Land use data can help identify possible contaminant activities or sources of pollution. These can often be identified from information that may be available from the local planning or building departments, including. These may include aerial photographs, topographic maps, zoning maps, and building permits.

Surveys may also be done to confirm or supplement information collected by other means. The surveys can help prioritize the contaminant sources or properties that need a more detailed review. Types of surveys include mail questionnaires, telephone surveys, personal interviews, and automobile windshield surveys.

A field review may be done to identify land uses and to look for potential sources of contamination not clearly identified by the previous methods. Items to document could include: abandoned or improperly destroyed wells, closely spaced septic systems, point source and non-point source contaminants, and changes in business use.

**Ranking of Contaminant Activities**

The objective of the inventory process in a protection program is to determine which of the potential sources of contamination pose the greatest threat to the water supply. Section 8.0 provides information that may be helpful in ranking the potential sources of contamination.

The quantity and/or amount of area that the source occupies in the protection area could be included in determining potential risk. Comments that explain the source and the determination of the potential risk could be included.

**Vulnerability analysis**

Information collected can be used to revise the vulnerability analysis, if appropriate. Updated information on the hydrogeology of the protection area, or other site specific data should also be included. The approach described in Section 8.0 should be followed in analyzing a source's vulnerability.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

**Update of assessment maps**

Results of the inventory could be illustrated on an updated map that identifies the drinking water source, zones and protection areas, and activities that are considered to be potential origins of significant contamination. Such a map is helpful in the development of a protection program and in describing the program to the public.

**Follow-Up Iterations**

Iterations are important in this process, particularly since, for many drinking water systems, a simple approach will be used for the initial assessment. A simple delineation and inventory may suggest that a drinking water source is at risk of contamination, while a more elaborate approach may show that the "risk" reflected the assumptions used and not the actual situation.

If an assessment shows a water supply to be vulnerable to one or more contaminants, the following steps should be taken, as part of developing a protection program:

- Reevaluate the zones and protection area to determine if they are accurate, and if necessary revise, using a more sophisticated method
- Collect more hydrogeologic data
- Collect more information on the PCAs and the specific contaminants of concern.

**11.4 Initiate Protection Measures, If Appropriate**

If the drinking water source is susceptible to contamination, protection measures may be taken. These might include increasing monitoring, abatement or remediation of the contaminant source, or planning for an alternative source of supply, or other management activities, as described in Sections 12.0 and 13.0.

**11.5 Provide Information to the Public**

When the drinking water system or community decides to make the findings of its protection efforts available to the public, the following methods are examples of those that may be used to provide information.

- Provide documents for review in public libraries
- Provide documents for review at county health/environmental health department
- Issue press releases that refer public to locations of documents for public review
- Mail notice to organizations identifying locations of documents for public review
- Mail notice to customers of locations of documents for public review
- Hold a public meeting that describes the findings of the protection program and refers to locations of documents for public review

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

- Mail assessment map and summary to customers/public
- Provide results in annual report to customers/public
- Make results available by electronic access (e.g., Internet)

In all cases, copies of source water assessment and protection reports should be provided to DHS.

**11.2.6 Source Water Assessment and Protection Information Updates**

The public water system or community should develop a schedule for updating its protection program. To be consistent with source water assessments, the protection program should be reviewed for possible update every five years.

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **12.0 Management Approaches within Drinking Water Source Protection Areas**

Source water protection is not a mandated element of the EPA's Source Water Assessment Program requirements. However, protection is required for a complete wellhead protection program. EPA and DHS encourage development of protection programs for all sources, recognizing that prevention of contamination is of greater benefit to the public and to drinking water utilities than dealing with it after the fact, through expensive drinking water monitoring and treatment, and through other expensive environmental cleanup activities.

A drinking water system with a completed source water assessment and a protection program may be eligible for waivers from monitoring. As mentioned previously for the assessment program, the State could require protection programs to be in place for permitting and waivers, particularly for water systems with sources that have detected levels of a regulated or unregulated chemical.

Drinking water systems and communities are encouraged to develop management strategies to mitigate the impact and risk of contamination of the drinking water supply. Another activity related to the DWSAP is contingency planning, which is discussed in Section 13.0

Management within source water protection areas is primarily the responsibility of local governments and public drinking water systems, supported and guided by State policies and programs. Source water protection activities in California can be divided into three categories. Each category is described further in this section:

1. State programs related to drinking water source protection
2. Recommended guidelines for management in protection areas
3. Local management activities

### **12.1 State Programs Related to Drinking Water Source Protection**

Existing state programs to protect water supplies and to inventory, regulate, and clean up contaminant sources are described in Section 5.0, Roles and Responsibilities of Government Agencies.

DHS will actively promote the development of local drinking water source protection programs. DHS' activities to promote protection of drinking water supplies include technical assistance, financial assistance, training, education, and demonstration projects.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

As each assessment performed by DHS is completed, the information will be shared with the public water system along with guidance for local protection programs.

**Technical Assistance**

The DHS Drinking Water Program has a source water (wellhead) protection coordinator available to assist local agencies with protection programs. In addition, within each Drinking Water Program district office, a staff person will be available for assistance. These DHS personnel can make presentations to water suppliers and community groups about source water protection, and can review technical elements of proposed programs.

**Financial Assistance**

California is establishing a State Revolving Fund (SRF) for drinking water. These funds will be primarily targeted to water system infrastructure improvements. However, some portion of the funding may be available for source water protection activities, once source water assessments have been completed. The state is currently developing guidelines for the SRF program.

**Training**

DHS, in conjunction with EPA, is preparing a training program in source water protection for utility operators, managers and board members. This training will be offered for the first time in 1999, and on a repeating basis thereafter throughout the state. Other organizations may offer training as well.

**Education**

DHS will be preparing educational materials for use by water utilities, community groups, and other interested parties. These materials may include additional guidance materials for implementation of the DWSAP Program.

**Demonstration Projects**

DHS is participating in several demonstration projects. The first community demonstration project is centered on ground water sources of Sebastopol in Sonoma County. That assessment and protection project is funded by the City of Sebastopol, with DHS providing project coordination and technical assistance. Another demonstration project is a drinking water source protection program for Yosemite National Park, funded by the US EPA and DHS. Additional ground water (wellhead) demonstration projects may occur, some to be done in conjunction with the California Rural Water Association.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*



**Directory of Source Water Protection-Related Activities**

DHS has prepared a directory of agency programs (see Section 5.0) to enable drinking water systems and communities to access pertinent information for drinking water source protection activities. The data directory will be available through the Internet.

**12.2 Recommended Guidelines for Management in Protection Areas and Zones**

The protection areas and zones mentioned in the following subsections refer to those identified in Section 6.0 for surface water and ground water sources.

**12.2.1 Surface Water Sources**

Surface water intakes, and land areas near surface water sources should be managed to reduce the possibility of contamination. Potential origins of contamination such as septic systems should be designed and used with appropriate precautions to ensure protection of surface water from microbial organisms. Chemicals capable of contaminating surface water should not be stored or used near surface water intakes or near surface water sources of drinking water, or should be stored and used with appropriate precautions to eliminate the possibility of spills or discharges.

If zones are established within a surface water source protection area (i.e., watershed), the zones that are farther from the source, yet still within the watershed, allow the community to appropriately plan and site future high risk and medium risk PCAs. These zones also serve as an educational tool for industry, the general public, and others to understand the source of their drinking water and the significance of their actions within a watershed or surface water source protection area.

**12.2.2 Ground Water Sources****12.2.2.1 Recharge Areas**

Where ground water recharge areas can be identified, they should be managed in a manner generally similar to that described above for surface water sources, using primary and secondary recharge areas (Section 6.3) to represent zones and protection areas.

**12.2.2.2 Zones**

Zones within the protection area of a ground water source allow the community to appropriately plan and site future high risk and medium risk PCAs. These zones also serve as an educational tool for industry, the general public, and others to understand the source of their drinking water and the significance of their actions upgradient or within the zones of their drinking water wells, and for the entire aquifer and recharge area, too.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

**Well Site Control Zone**

The well site control zone should be managed to reduce the possibility of surface flows reaching the wellhead and traveling down the casing. It is recommended that the water purveyor own this area, or have a permanent easement. Within this zone, the immediate vicinity of the well should be fenced and locked, or may include a well house or other building. It is not necessary for the entire zone to be fenced.

**Zone A - Microbial/Direct Chemical Contamination Zone**

Within Zone A, the microbial/direct chemical contamination zone established on the basis of the two-year time of travel, activities that could be potential sources of microbial or direct chemical contamination should be strictly managed to eliminate or reduce the risk of contamination of the water supply.

Potential sources of contamination such as septic systems should be designed and used with appropriate precautions to ensure appreciable reduction in nitrates and microbial organisms before reaching ground water or surface water.

Activities should be managed so that chemicals capable of contaminating ground water would not be stored or used, or would be stored and used with appropriate precautions to eliminate the possibility of spills or discharges.

**Zones B5 and B10 - Chemical Contamination Zones**

Zone B5, the area within the five-year time-of-travel, should be actively managed for control of potential chemical contaminants. Within Zone B5, chemicals capable of contaminating ground water should be stored and used with appropriate precautions to eliminate the possibility of spills or discharges.

Zone B10, the area between the five- and ten-year time-of-travel, allows the community to plan and site future high risk and medium risk sources of ground water contamination at a distance from the source where they are less likely to contaminate the water supply.

**Buffer Zone - Additional Chemical Contamination Zone**

A buffer zone enables additional planning for particular activities that may affect the community's ground water supplies.

### 12.3 Local Management Actions

After identifying protection areas, zones, and PCAs, and prioritizing PCAs, the local community or water supplier may choose to develop a management strategy for protecting the water supply. These activities would be accomplished at the local level, and may affect agencies, districts or other communities besides the community served by the water supply. The cooperation of the entire community is vital for source water protection management strategies to work.

There are both non-regulatory and regulatory management strategies that can be effective as part of a source water protection program. The easiest ones to implement are non-regulatory, and they may be very successful. If, however, as a result of the PCA inventory and vulnerability analysis, a local community determines that the water supply is at high risk of contamination, then land use planning, permitting, and possibly more restrictive regulatory methods may be necessary to ensure protection of the water supply. Potential local management strategies are listed in Table 12-1.

Water systems and communities interested in developing local protection programs are encouraged to review the resources and contact the organizations listed below. In addition, DHS intends to develop state-specific guidance for local protection programs.

#### Source Water Protection and Wellhead Protection Documents

*A Guide to Wellhead Protection*, Witten, J. and Horsley, S., American Planning Association, Planning Advisory Service, Report #457/458, August, 1995,

*Basic Ground-Water Hydrology*, USGS Publication #2220

*California Groundwater Management*, Groundwater Resources Association of California

*Delineation of Wellhead Protection Areas in Fracture Rocks*, EPA Publication EPA570991009

*Ground Water and Wellhead Protection*, EPA Handbook EPA625/R94001

*Guide to Groundwater Supply Contingency Planning for Local and State Government*, EPA Technical Assistance Document EPA4404690003

*Guidelines for Delineation of Wellhead Protection Areas*, EPA Publication EPA440593001

*Protecting Local Ground-water Supplies through Wellhead Protection*, EPA Publication EPA570991007

*Wellhead Protection : A Guide for Small Communities*, EPA Document 25/R-93/002

*Wellhead Protection in Confined, Semi-Confined, Fractured, Aquifer Settings*, EPA Publication ERIC: G-127, EPA813K93001, NTIS:PB94-109402

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

*Wellhead Protection Programs: Tools for Local Governments*, EPA Publication EPA440/6-89/002

*Wellhead Protection Strategies for Confined Aquifer Settings*, EPA Publication EPA570991008

*Wellhead Protection: A Guide for Small Communities*, EPA Seminar Publication EPA625R93002

*Why Do Wellhead Protection? Issues and Answers in Protecting Public Drinking Water Supply Systems*, EPA Publication EPA813K95001

**Organizations**

California Groundwater Association  
P.O. Box 14369  
Santa Rosa, California 95402-6369  
(707) 578-4408

Water Education Foundation  
717 K Street, Suite 517  
Sacramento, California 95814  
(916) 444-6240

California Rural Water Association  
8300 Fair Oaks Boulevard, Suite 302  
Carmichael, California 95608  
1-800-833-0322

The GroundWater Foundation  
P.O. Box 22558  
Lincoln, Nebraska 68542-2558  
(402) 434-2740

Groundwater Resources Association of  
California  
601 Villanova Drive  
Davis, California 95616  
(530) 758-3656

National Rural Water Association  
2915 South 13<sup>th</sup> Street  
Duncan, Oklahoma 73533  
(405) 252-0629

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

**Table 12-1. Potential local management strategies for source water protection programs.**

**Regulatory**

Zoning

Overlay Ground water Protection  
Districts  
Prohibition of Various Land Uses  
Special Permitting  
Large-Lot Zoning  
Transfer of Development Rights  
Cluster/PUD Design  
Growth Controls/Timing  
Performance Standards

Subdivision Control

Drainage Requirements  
Impact Fees

Health Regulations

Underground Fuel Storage Systems  
Privately Owned Small Wastewater  
Treatment Plants  
Septic Cleaner Ban  
Septic System Upgrades  
Toxic and Hazardous Materials  
Handling Regulations  
Private Well Protection

**Non-Regulatory**

Land Transfer and Voluntary  
Restrictions

Sale/Donation  
Conservation Easements  
Limited Development

Other

Watershed Restoration Efforts  
Monitoring  
Contingency Plans  
Hazardous Waste Collection  
Public Education

**Legislative**

Regional Wellhead Protection Area  
Districts  
Land Banking

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 4 6

## **13.0 Contingency Planning for Drinking Water Supplies**

Contingency planning to protect drinking water supplies is an essential element of a complete source water protection program. It is also required by the Safe Drinking Water Act (SDWA) and the Emergency Planning and Community Right-to-Know Act of 1986, enacted as Title III of the Superfund Amendments and Re-authorization Act (SARA).

Local governments are typically given responsibility for implementing components of a drinking water source protection program. While program requirements may vary, a public water supplier should develop a contingency plan to locate and provide alternate drinking water supplies in the event of contamination. A contingency plan should not be limited to planning for alternative supplies; it should be used to identify and to prevent both physical and operational threats from contaminating or closing a public water supply.

The following are minimum components for local contingency plans. These will ensure adequate planning, encourage reliability and consistency, and create uniform response protocols. Any local plan should be consistent with Urban Water Plans.

A contingency plan could be made a condition of a public water system's water supply permit. Such a plan is required for a complete wellhead protection program.

### **13.1 Contingency Planning at the State Level**

Contingency planning at the state level is also an important component of the State Drinking Water Source Assessment and Protection Program. A state plan would identify state roles, responsibilities, and resources.

A State Contingency Plan could include the following activities: Analysis of the characteristics of water systems statewide; analysis of the vulnerability of surface and ground water supplies statewide; review of existing State emergency response plans; analysis of water supply replacement options statewide; evaluation of the State's technical, logistical, and financial resources to support local response activities; development of guidance and standards to direct local plan development; identification of future steps that should be taken to prevent or mitigate future disruptions; improvement of the State's ability to respond to major supply disruptions; and organization of a process for reviewing and updating the plan.

A State Contingency Plan would provide the overall framework for state and local responses and integrate other state and federal programs, and provide direction for local plans. A State Contingency Plan could be developed after EPA approval of the State Drinking Water Source Assessment and Protection Program.

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

## **13.2 Minimum Components of Local Contingency Plans**

A local contingency plan should include an assessment of the water system's ability to function with a loss of major supply, and it should address alternate supplies in case they are needed. Specific steps are identified in this section.

### **13.2.1 Assessment of the Ability of the Water System to Function with the Loss of the Largest Source of Supply**

In order to assess the ability to function with the loss of the largest source of supply, the water supplier should do the following: (1) Identify the maximum water system capacity in relation to source, distribution system, and water rights or other restrictions; and (2) re-evaluate this capacity with the loss of the largest supply source.

### **13.2.2 Development of a Plan for Alternate Water Supplies**

To develop a plan for alternate water supplies, the water supplier should determine both short-term and long-term supplies, the additional capacity that would be provided, and the associated costs. The plan should consider such alternatives as: expanding existing sources, identifying existing and potential inter-ties with other public water systems, developing new sources, and installing treatment on sources not currently used because of water quality problems.

### **13.2.3 Development of a Spill/Incident Response Plan**

Using the results of the PCA inventory, a response plan for spills and emergencies should be developed with local emergency responders. Emergency response actions to be taken should consider protection of the water supply. For example, chemical spills within the protection area should be soaked up with absorbent materials rather than being washed away to drainage systems. Similarly, in the event of a fire it may be best to allow certain facilities to burn rather than have contaminated runoff that could pollute the community water supply.



## References

- American Water Works Association, California-Nevada Section, 1993. *Watershed Sanitary Survey Guidance Manual*. Source Water Quality Committee, December.
- California Department of Water Resources, California Well Standards, DWR Bulletin 74-81.
- California Department of Water Resources, California Well Standards, DWR Bulletin 74-90.
- Massachusetts Department of Environmental Protection, 1996. *Developing a Local Surface Water Supply Protection Plan*.
- Todd, D.K. 1980. *Groundwater Hydrology*. 2nd Ed. New York: John Wiley & Sons.
- Washington State Department of Health, Environmental Health Programs. 1995. *Washington State Wellhead Protection Program Guidance Document*. Olympia, Washington. DOH Publication 331-018, April.
- US Environmental Protection Agency, 1997. *State Methods for Delineating Source Water Protection Areas for Surface Water Supplied Sources of Drinking Water*, EPA 816-R-97-008, August.
- US Environmental Protection Agency, 1997. *State Source Water Assessment and Protection Programs Guidance*, Final Guidance, Office of Water, EPA 816-R-97-009, August.
- Witten, J. and Horsley, S., 1995. *A Guide to Wellhead Protection*. American Planning Association, Planning Advisory Service, Report #457/458. August.

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 5 0

D-042274.150

## Appendices

Drinking water systems and communities that choose to perform their own source water assessments as part of a drinking water source assessment and protection program should contact their regional DHS drinking water office to make sure they are using the up-to-date version of the forms and checklists contained in the Appendices.

### **APPENDICES TO BE USED FOR A SURFACE WATER SOURCE**

Appendix A—Location of Surface Water Source

Appendix B—Delineation of Surface Water Source Protection Areas and Zones

Appendix C—Physical Barrier Effectiveness Checklist - Surface Water Source

Appendix D—Possible Contaminating Activity (PCA) Inventory Forms and Checklists - Surface Water Source

Appendix E—PCA Evaluation Procedures - Surface Water Source

Appendix F—Vulnerability Analysis Procedures - Surface Water Source

Appendix G—Checklist for Drinking Water Source Assessment Report - Surface Water Source

### **APPENDICES TO BE USED FOR A GROUND WATER SOURCE**

Appendix H—Location of Ground Water Source

Appendix I—Delineation of Ground Water Source Protection Areas and Zones

Appendix J—Physical Barrier Effectiveness Checklist - Ground Water Source

Appendix K—Possible Contaminating Activity (PCA) Inventory Forms and Checklists - Ground Water Source

Appendix L—PCA Evaluation Procedures - Ground Water Source

Appendix M—Vulnerability Analysis Procedures - Ground Water Source

Appendix N—Checklist for Drinking Water Source Assessment Report - Ground Water Source

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 5 2

D-042274.152

*California Drinking Water Source Assessment and Protection Program*

**APPENDICES TO BE USED FOR A SURFACE WATER SOURCE**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

**D — 0 4 2 2 7 4 — 1 5 3**

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 5 4

**Appendix A****Drinking Water Source Location****Surface water source**

Public water system and ID No.:

Name of source and ID No.:

Location date:

Source located by (name of person):

Global Positioning System (GPS) Unit(manufacturer/model):

Accuracy of GPS unit (+/- \_\_\_\_ ft.)

Location of intake:

Latitude:

Longitude:

Physical description of location [Name of surface water body, pertinent landmarks, address, or approximate address (cross streets, etc.)]:

**NOTE: Indicate location of the surface water intake on the drinking water source assessment map. Map should also indicate the source's protection area and its zones, if established, as well as locations of possible contaminating activities (See other Appendices).**

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 5 6

D-042274.156



**Appendix B****Delineation of Surface Water Source Zones**

Public water system and ID No.:

Name of Source and ID No.:

The delineation of zones for a surface water source is optional. The protection area for a surface water source is the watershed.

If zones are established, the minimum distances are as follows:

400 feet from reservoir boundaries  
200 feet from tributaries  
2,500 feet from intakes

Zones used for this source, if established, are:

\_\_\_\_\_ feet from reservoir boundaries  
\_\_\_\_\_ feet from tributaries  
\_\_\_\_\_ feet from intakes

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 5 8

D-042274.158

## Appendix C

### Source and Site Characteristics Checklist -- Surface Water Source

#### Physical Barrier Effectiveness Determination

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

#### Drinking Water Source/ Watershed Information

Note: Most of the following information should be available from the Watershed Sanitary Survey of the water source.

1. Is the source an impounded reservoir or a direct stream intake?
  - a. Reservoir
  - b. Stream intake
  - c. Other, describe: \_\_\_\_\_
2. Source Characteristics
  - a. Area of tributary watershed: \_\_\_\_\_ acres or square miles
  - b. Area of water body within watershed: \_\_\_\_\_ acres or square miles
  - c. Volume of water body: \_\_\_\_\_ acre-feet
  - d. Maximum rate of withdrawal through intake: \_\_\_\_\_ gallons per day
  - e. Are the primary tributaries seasonal, perennial or both? \_\_\_\_\_
3. What is the approximate travel time to the intake for water at farthest reaches of the water body?
  - a. Source is direct intake, no impounded water body
  - b. Less than 30 days
  - c. More than 30 days and less than 1 year
  - d. More than 1 year
4. What is the general topography of the watershed?
  - a. Flat terrain (<10% slopes)
  - b. Hilly (10 to 30% slopes)
  - c. Mountainous (> 30% slopes)
  - d. Not sure

*California Drinking Water Source Assessment and Protection Program*

5. What is the general geology of the watershed?
  - a. Materials prone to landslides
  - b. Materials not prone to landslides
  - c. Not sure
6. What general soil types are on the watershed?
  - a. Rock
  - b. Loams, sands
  - c. Clay
  - d. Not sure
7. What type of vegetation covers most of the watershed?
  - a. Grasses
  - b. Low growing plants and shrubs
  - c. Trees
  - d. Not sure
8. What is the mean seasonal precipitation on the watershed?
  - a. More than 40 inches/year
  - b. 10 to 40 inches/year
  - c. Less than 10 inches/year
  - d. Not sure
9. Is there significant ground water recharge to the water body?
  - a. Yes
  - b. No
  - c. Not sure

*California Drinking Water Source Assessment and Protection Program***Physical Barrier Effectiveness Determination****Parameters indicating Low Physical Barrier Effectiveness (LE)**

(A source with any of the parameters listed below would be considered to have less effective physical barrier properties)

3a  
4c or 4d  
5a or 5c  
7c or 7d  
8a or 8d  
9a

**Parameters indicating High Physical Barrier Effectiveness (HE)**

(A source would need to have all of the parameters listed below to be considered to have highly effective physical barrier properties)

3d and  
4a and  
5b and  
7a and  
8c and  
9b

All other sources are considered to have **Moderate Physical Barrier Effectiveness**

Determination for this source:

Low (LE)

Moderate (ME)

High (HE)

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 6 2

**Appendix D****Possible Contaminating Activities (PCA) Inventory Form****Surface Water Source**

Public water system and ID No.: \_\_\_\_\_

Name of drinking water source and ID No. \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by: \_\_\_\_\_

Name of Surface Water Body : \_\_\_\_\_

Indicate PCAs pertinent to the drinking water source, its protection area and zones (if established), from the following tables, as applicable:

Commercial/Industrial (Table D-1) \_\_\_\_\_

Residential/Municipal (Table D-2) \_\_\_\_\_

Agricultural/Rural (Table D-3) \_\_\_\_\_

Other (required for all) (Table D-4) \_\_\_\_\_

Are zones established? YES or NO

Attach map of Drinking Water Source with watershed boundaries and zones (if established) indicated.

Proceed to appropriate checklist or checklists. Place a mark in the appropriate boxes.  
Example:

		X

Risk Ranking of PCAs (see Tables 7-2, 7-3, 7-4 and 7-5 for separate category lists), where VH = Very High Risk, H = High Risk, M = Moderate Risk, L = Low Risk

page intentionally blank



*California Drinking Water Source Assessment and Protection Program*

PCA Checklist						
Table D-1, page 1 of 3						
COMMERCIAL/INDUSTRIAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
<b>Automobile-related activities</b>						
Body shops (H)						
Car washes (M)						
Gas stations (VH)						
Repair shops (H)						
Boat services/repair/refinishing (H)						
Chemical/petroleum processing/storage (VH)						
Chemical/petroleum pipelines (H)						
Dry cleaners (VH)						
Electrical/electronic manufacturing (H)						
Fleet/truck/bus terminals (H)						
Furniture repair/manufacturing (H)						
Home manufacturing (H)						
Junk/scrap/salvage yards (H)						
Machine shops (H)						
Metal plating/finishing/fabricating (VH)						
Photo processing/printing (H)						

## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table D-1, page 2 of 3						
COMMERCIAL/INDUSTRIAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
Plastics/synthetics producers (VH)						
Research laboratories (H)						
Wood preserving/treating (H)						
Wood/pulp/paper processing and mills (H)						
Sewer lines (H, if in Zone A, otherwise L)						
Parking lots/malls (>50 spaces) (M)						
Cement/concrete plants (M)						
Food processing (M)						
Funeral services/graveyards (M)						
Hardware/lumber/parts stores (M)						
Appliance/Electronic Repair (L)						
Office buildings/complexes (L)						
Rental Yards (L)						
RV/mini storage (L)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table D-1, page 3 of 3						
COMMERCIAL/INDUSTRIAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
Other (list)						

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 6 7

D-042274.167

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 6 8

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table D-2, page 1 of 2 RESIDENTIAL/MUNICIPAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
Airports - Maintenance/fueling areas (VH)						
Landfills/dumps (VH)						
Railroad yards/maintenance/ fueling areas (H)						
Septic systems - high density (>1/acre) (VH if in Zone A, otherwise M)						
Sewer lines (H, if in Zone A, otherwise L)						
Utility stations - maintenance areas (H)						
Wastewater treatment plants (VH in Zone A, otherwise H)						
Drinking water treatment plants (M)						
Golf courses (M)						
Housing - high density (>1 house/0.5 acres) (M)						
Motor pools (M)						
Parks (M)						
Waste transfer/recycling stations (M)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

D - 0 4 2 2 7 4 - 1 6 9

D-042274.169

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table D-2, page 2 of 2 RESIDENTIAL/MUNICIPAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
Apartments and condominiums (L)						
Campgrounds (L)						
Fire stations (L)						
Schools (L)						
RV Parks (L)						
Other (list)						

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 7 0

D-042274.170

## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table D-3, page 1 of 2						
AGRICULTURAL/RURAL						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
<b>Confined Animal Feeding Operations (CAFOs)</b>						
Auction lots (>50 head/acre) (VH in Zone A, otherwise H)						
Beef cattle (>50 head/acre) (VH in Zone A, otherwise H)						
Chicken/turkeys (> 200/facility) (VH in Zone A, otherwise H)						
Dairy cattle (>50 head/acre) (VH in Zone A, otherwise H)						
Sheep (>50 head/acre) (VH in Zone A, otherwise H)						
Swine (> 50 head/acre) (VH in Zone A, otherwise H)						
Other animal facilities (VH in Zone A, otherwise H)						
Farm chemical distributor/ application service (H)						
Farm machinery repair (H)						
<b>Residential parcels, &gt; 1 acre</b>						
Machine shops (H)						
Septic systems (H in Zone A, otherwise L)						
Lagoons / liquid wastes (H)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

## California Drinking Water Source Assessment and Protection Program

PCA Checklist Table D-3, page 2 of 2 AGRICULTURAL/RURAL						
PCA (Risk Ranking)	If Zones Established			PCA in Watershed	Unknown	Comments
	No PCA in zones	PCA in Zone A	PCA in Zone B			
Pesticide/fertilizer/ petroleum storage & transfer areas (H)						
Agricultural/Irrigation wells (H)						
Crops, irrigated (Berries, hops, mint, orchards, sod, greenhouses, vineyards, nurseries, vegetable) (M)						
Sewage sludge/biosolids application (M)						
Fertilizer, Pesticide/ Herbicide Application without Resource Management (M)						
Crops, nonirrigated (e.g., Christmas trees, grains, grass seeds, hay, pasture) (L)						
Fertilizer, Pesticide/ Herbicide Application with Resource Management (L)						
Other (list)						



## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table D-4, page 1 of 4						
OTHER ACTIVITIES						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
NPDES permitted discharges (H)						
Underground Injection of Commercial/Industrial Discharges (VH)						
Historic gas stations (VH)						
Historic waste dumps/landfills (VH)						
Illegal activities/unauthorized dumping (H)						
Injection wells/ dry wells/ sumps (VH)						
Military installations (VH)						
Mining operations - Historic (VH)						
Mining operations - Active (VH)						
Mining - Sand/Gravel (H)						
Wells - Oil, Gas, Geothermal (H)						
Known Contaminant Plumes (H)						
Salt Water Intrusion (H)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table D-4, page 2 of 4 OTHER ACTIVITIES						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
Recreational area— surface water source (H)						
Underground storage tanks						
Confirmed leaking tanks (VH)						
Decommissioned - inactive tanks (L)						
Non-regulated tanks (tanks smaller than regulatory limit) (H)						
Not yet upgraded or registered tanks (H)						
Upgraded and/or registered - active tanks (L)						
Above ground storage tanks (M)						
Wells – Water supply, monitoring, test holes (M)						
Construction/demolition staging areas (M)						
Contractor or government agency equipment storage yards (M)						
Managed forests (M)						

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table D-4, page 3 of 4 OTHER ACTIVITIES						
	If Zones Established					
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown	Comments
<b>Transportation corridors</b>						
Freeways/state highways (M)						
Railroads (M)						
Historic railroad right-of-ways (M)						
Road Right-of-ways (herbicide use areas) (M)						
Roads/ Streets (L)						
Hospitals (M)						
Storm Drain Discharge Points (M)						
Storm Water Detention Facilities (M)						
<b>Artificial Recharge Projects</b>						
Injection wells (potable water) (L)						
Injection wells (non-potable water) (M)						
Spreading Basins (potable water) (L)						
Spreading Basins (non-potable water) (M)						

[illegible]

## Appendix E

### Possible Contaminating Activities Evaluation – Surface Water Source

(Note: This form is OPTIONAL. It should be completed if a modification of the risk ranking of a PCA is desired)

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

#### PCA/Potential Contaminant Information

1. Type of Activity (from contaminant inventory checklist):
2. Type of potential contaminant associated with this activity (refer to Table 7-2):
  - a. Microbiological
  - b. Chemical
  - c. Both or Other
3. Potential Risk (from PCA contaminant inventory checklist):
  - a. Low
  - b. Medium
  - c. High
  - d. Very High
4. Location:
  - a. Within a zone (if defined) or within DHS minimum setback distances
  - b. On the watershed outside of zones (if defined) or outside DHS minimum setback distances
  - c. On the watershed (if no zones defined)
5. Spatial Area occupied by activity as percentage of watershed area:
  - a. Small (<5% of area)
  - b. Moderate (5% to 25% of area)
  - c. High (>25% of area)
  - d. Unknown
6. Volume of potential contaminant (*not applicable for microbiological contaminants*):  
 If the maximum quantity of potential contaminant stored at the facility were discharged into the quantity of water produced by the drinking water supply in a day would the concentration be:
  - a. Small (less than one part per billion)

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

- b. Moderate (between one part per thousand and one part per billion)
  - c. High (more than one part per thousand)
  - d. Unknown
7. Magnitude of potential acute or chronic health effects associated with the contaminant:
- a. Low
  - b. High
  - c. Unknown
8. Likelihood of potential contaminant to migrate to drinking water supply:
- a. Low
  - b. High
  - c. Unknown
9. Has the potential contaminant been detected in the drinking water supply or near-by monitoring wells?
- a. Yes
  - b. No
  - c. Unknown
10. Compliance of facility (demonstrated performance to keep potential contaminant from being discharged)
- a. Good
  - b. Poor
  - c. Unknown

**Determination of revised risk ranking for PCAs****Microbiological Contamination**

If the PCA is categorized as **2a or 2c**, the risk ranking would be LOW if the PCA meets all of the parameters in the table below for **Low**. The risk ranking would be HIGH if the PCA meets all of the parameters in the table for **High**. Otherwise the risk ranking is MODERATE.

**Microbiological Contamination  
PCA Risk Ranking**

Parameter	Low	High
3	a	c or d
4	b	a or c
5	a	c or d
7	a	b or c
8	a	b or c
9	b	a or c
10	a	b or c

**Chemical Contamination**

If the PCA is categorized as **2b or 2c**, the risk ranking would be LOW if the PCA meets all of the parameters in the table below for **Low**. The risk ranking would be HIGH if the PCA meets all of the parameters in the table for **High**. Otherwise the risk ranking is MODERATE.

**Chemical Contamination  
PCA Risk Ranking**

Parameter	Low	High
3	a	c or d
4	b	a or c
5	a	c or d
6	a	c or d
7	a	b or c
8	a	b or c
9	b	a or c
10	a	b or c

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 8 0

D-042274.180



## Appendix F

### Vulnerability Analysis Procedures – Surface Water Source

The Vulnerability analysis incorporates the Possible Contaminating Activities (PCAs) identified in the inventory, their respective Risk Rankings, the Zone and the Physical Barrier Effectiveness determination. These factors are used to determine the PCAs to which the drinking water source is most vulnerable.

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

#### Vulnerability analysis steps:

1. For each PCA identified as existing in the protection area, or unknown, determine number of points for that PCA. (If the risk ranking for a PCA has been modified, Appendix E should be attached). *(For example, Very High (VH) risk activities are 7 points.)*
2. For each PCA determine which zone in which it occurs (if zones are defined, or within the watershed if zones are not defined). Add the points associated with that zone. If the PCA exists within more than one zone, repeat the process for each zone. *(For example, if the PCA exists in Zone A add 5 points. For a VH risk PCA in Zone A, the PCA + Zone points = 7 + 5 = 12 points.)*
3. For each Drinking Water Source determine the Physical Barrier Effectiveness (PBE) (from Appendix C). Add the points associated with that PBE. *(For example, if the PBE is Low add 5 points. For a VH risk PCA in Zone A, the Vulnerability Points = PCA points + Zone points + PBE points = 7 + 5 + 5 = 17 points.)*
4. Prioritize all PCAs by the Vulnerability Points, from the most points to the least. A sample form is shown below.
5. Drinking Water Source is vulnerable to all PCAs with Vulnerability Points **8** or greater. Refer to the Vulnerability Matrix below.
6. **In addition, the Drinking Water Source is vulnerable to all PCAs associated with a contaminant detected in the water source, regardless of Vulnerability Points.**

*California Drinking Water Source Assessment and Protection Program*

**Vulnerability Matrix for SURFACE WATER SOURCES**

**INDICATE WHICH APPLIES:**

**WITHIN ZONES** (if defined) OR

**WITHIN ENTIRE WATERSHED** (if zones are not defined)

The cutoff point for vulnerability is 8. The drinking water source is considered Vulnerable to all PCAs with Vulnerability Score greater than or equal to 8 (shaded boxes).

PCA points	Zone points		PCA + Zone points	PBE Points			Vulnerability Score PCA + Zone + PBE points		
Risk Ranking	Zones Defined	Zones Not Defined		Low	Med	High	PBE Low	PBE Med	PBE High
VH (7)	A (5)	Watershed (5)	12	5	3	1	17	15	13
VH (7)	B (3)		10	5	3	1	15	13	11
VH (7)	Watershed (1)		8	5	3	1	13	11	9
VH (7)	Unknown (0)	Unknown (0)	7	5	3	1	12	10	8
H (5)	A (5)	Watershed (5)	10	5	3	1	15	13	11
H (5)	B (3)		8	5	3	1	13	11	9
H (5)	Watershed (1)		6	5	3	1	11	9	7
H (5)	Unknown (0)	Unknown (0)	5	5	3	1	10	8	6
M (3)	A (5)	Watershed (5)	8	5	3	1	13	11	9
M (3)	B (3)		6	5	3	1	11	9	7
M (3)	Watershed (1)		4	5	3	1	9	7	5
M (3)	Unknown (0)	Unknown (0)	3	5	3	1	8	6	4
L (1)	A (5)	Watershed (5)	6	5	3	1	11	9	7
L (1)	B (3)		4	5	3	1	9	7	5
L (1)	Watershed (1)		2	5	3	1	7	5	1
L (1)	Unknown (0)	Unknown (0)	1	5	3	1	6	4	2

\* Source is considered vulnerable to PCAs that are Unknown, if the Vulnerability points are 8 or higher. Therefore, a source is vulnerable to all Very High risk PCAs if it is unknown whether the PCAs exist.

**List PCAs in order by Vulnerability Score from highest to lowest.**

[illegible]

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 8 4

D-042274.184

## Appendix G

### Checklist for Drinking Water Source Assessment - Surface Water Source

The following information should be contained in the drinking water source assessment report.

If another report that is the functional equivalent to the drinking water assessment (e.g., a watershed sanitary survey) is included in this assessment, the part of that report that fulfills the requirements of the source water assessment should be clearly indicated.

- \_\_\_\_\_ Source name, system name, and source and system identification numbers
- \_\_\_\_\_ Date of assessment and name of person and organization conducting the assessment
- \_\_\_\_\_ Drinking water source location and accuracy of method used (Appendix A)
- \_\_\_\_\_ Identification of delineated zones, if applicable (Appendix B)
- \_\_\_\_\_ Drinking water Physical Barrier Effectiveness Checklist (Appendix C)
- \_\_\_\_\_ Possible contaminating activities (PCA) inventory forms (Appendix D).
- \_\_\_\_\_ PCA evaluation procedures (optional) (Appendix E)
- \_\_\_\_\_ Vulnerability analysis procedures (Appendix F)
- \_\_\_\_\_ Map with surface water intake location, protection areas and zones (if applicable), and high and moderate risk PCAs in protection area (or in zones, if they are established).
- \_\_\_\_\_ Means of Public Availability of Report (indicate those that will be used)
  - \_\_\_\_\_ Notice in the annual water quality/consumer confidence report\* (required)
  - \_\_\_\_\_ Copy in DHS district office (required)
  - \_\_\_\_\_ Copy in public water supply office (recommended)
  - \_\_\_\_\_ Copy in public library/libraries
  - \_\_\_\_\_ Internet (indicate Internet address: \_\_\_\_\_)
  - \_\_\_\_\_ Other (describe)

\*The annual report should indicate where customers can review the assessments.

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 8 6

**APPENDICES TO BE USED FOR A GROUND WATER SOURCE**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 8 8

D-042274.188



## Appendix H

### Drinking Water Source Location

#### Ground water source

Public water system and ID No.:

Name of source and ID No.:

Location date:                      Source located by (name of person):

Global Positioning System (GPS) Unit(manufacturer/model):

Accuracy of GPS unit (+/- \_\_\_\_ ft.)

Location of well:                      Latitude:

Longitude:

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

Location of recharge area, if known:

**NOTE: Indicate location of the well on the drinking water source assessment map. The map should also indicate locations of the source's protection areas and zones, and possible contaminating activities (See other Appendices).**

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 9 0

D-042274.190

## Appendix I

### Delineation of Ground Water Zones

Public Water System Name:

Water System Identification Number:

Source Name:

Source Number:

Indicate the method used to delineate the zones:

\_\_\_\_\_ Calculated Fixed Radius (Default) (Show calculations below)

\_\_\_\_\_ Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow)

\_\_\_\_\_ More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling):

\_\_\_\_\_ Arbitrary Fixed Radius (For use only by or with permission of DHS—use minimum distances shown below)

#### Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is  $R_t = \sqrt{Q t / \pi \eta H}$  $R_t = R_2, R_5, \text{ or } R_{10}$  corresponding to  $t$  (Calculate R for each of three times of travel, TOT) $Q$  = maximum pumping capacity of well ( $\text{ft}^3/\text{year} = \text{gpm} * 70,267$ ): \_\_\_\_\_ $t$  = time of travel (years), 2, 5 and 10 years $\pi = 3.1416$  $\eta$  = effective porosity (decimal percent) (If unknown, assume 0.2): \_\_\_\_\_ $H$  = screened interval of well (feet) (If unknown, assume 10% of  $Q$  gpm, 10 ft minimum): \_\_\_\_\_

**Specific methods follow on next page**

**Calculated Fixed Radius Delineation Method (Default)**

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

**Porous Media Aquifer**

Zone A (2 year TOT)  $R_2 =$  \_\_\_\_\_ ft, minimum = 600 ft—use larger: \_\_\_\_\_ ft  
 Zone B5 (5 year TOT)  $R_5 =$  \_\_\_\_\_ ft, minimum = 1,000 ft—use larger: \_\_\_\_\_ ft  
 Zone B10 (10 year TOT)  $R_{10} =$  \_\_\_\_\_ ft, minimum = 1,500 ft—use larger: \_\_\_\_\_ ft

**Fractured Rock Aquifer**

(Increase size of zones by 50%)

Zone A (2 year TOT)  $1.5R_2 =$  \_\_\_\_\_ ft, minimum = 900 ft—use larger: \_\_\_\_\_ ft  
 Zone B5 (5 year TOT)  $1.5R_5 =$  \_\_\_\_\_ ft, minimum = 1,500 ft—use larger: \_\_\_\_\_ ft  
 Zone B10 (10 year TOT)  $1.5R_{10} =$  \_\_\_\_\_ ft, minimum = 2,250 ft—use larger: \_\_\_\_\_ ft

**Modified Calculated Fixed Radius Delineation Method**

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by  $0.5R_4$ . The upgradient and downgradient limits of the zone are determined below.

**Zone A (2-year TOT)**

upgradient distance =  $1.5R_2 =$  \_\_\_\_\_ ft, minimum = 900 ft—use larger: \_\_\_\_\_ ft  
 downgradient distance =  $0.5R_2 =$  \_\_\_\_\_ ft, minimum = 300 ft—use larger: \_\_\_\_\_ ft

**Zone B5 (5-year TOT)**

upgradient distance =  $1.5R_5 =$  \_\_\_\_\_ ft, minimum = 1,500 ft—use larger: \_\_\_\_\_ ft  
 downgradient distance =  $0.5R_5 =$  \_\_\_\_\_ ft, minimum = 500 ft—use larger: \_\_\_\_\_ ft

**Zone B10 (10-year TOT)**

upgradient distance =  $1.5R_{10} =$  \_\_\_\_\_ ft, minimum = 2,250 ft—use larger: \_\_\_\_\_ ft  
 downgradient distance =  $0.5R_{10} =$  \_\_\_\_\_ ft, minimum = 750 ft—use larger: \_\_\_\_\_ ft

## Appendix J

### Source and Site Characteristics Checklist - Ground Water Source

#### Physical Barrier Effectiveness Determination

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

Complete DHS Well Data Sheet (attached) and include with Assessment Report

#### Directions:

1. Read through the form and collect the information needed to complete the form. (Hydrogeology, Soils, Presence of abandoned or improperly destroyed wells, Well construction and operation.)
2. Determine Parameter A, Type of Aquifer.
  - If the aquifer is confined, use the right-hand column, and evaluate only the parameters indicated for confined aquifers.
  - If the aquifer is unconfined, or semi-confined, or the degree of confinement is unknown, use the left-hand column and evaluate only the parameters for unconfined aquifers.
3. For each parameter appropriate for the source, place a check in the box for the answer that most closely applies to that source. If more than one answer is possible, select the more conservative (i.e. lower points) answer. *[For example, if the depth to static water (Parameter D) has varied between 45 and 55 feet, choose answer 2 (20 to 50 feet).]*
4. Add the points in the column appropriate for the source and interpret the score as shown on the bottom of the last page.
  - Determine whether the source has a High, Moderate or Low Physical Barrier Effectiveness. Use this in the Vulnerability analysis. The higher the points, usually the more effective the source and site are to retarding the movement of contaminants to the water supply.

NOTE: If the source is located in fractured rock the source is considered to have a Low Physical Barrier Effectiveness, regardless of the point total. So, if Parameter B, Aquifer Material, is 3 (Low), the remainder of the form does not need to be completed.

## California Drinking Water Source Assessment and Protection Program

## Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name: \_\_\_\_\_

PARAMETER	POINTS			
	Unconfined		Confined	
<b>A. TYPE OF AQUIFER</b>				
Confinement (up to 40 points maximum) choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
<b>B. AQUIFER MATERIAL (Unconfined Aquifer)</b>				
Type of within the aquifer (up to 20 points maximum) choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	10			
3. Fractured rock *	0			
(* Low Physical Barrier Effectiveness - no further questions required)				
<b>C. PATHWAYS OF CONTAMINATION (All Aquifers)</b>				
Presence of Abandoned or Improperly Destroyed Wells (up to 10 points maximum)				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	5		5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	3		3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	2		2	
<b>D. STATIC WATER CONDITIONS (Unconfined Aquifer)</b>				
Depth to static Water (DTW) = _____ feet				
(up to 10 points maximum) choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2			
3. 50 to 100 feet	6			
4. > 100 feet	10			
<b>E. WELL OPERATION (Unconfined Aquifer)</b>				
Depth to Uppermost Perforations (DUP) DUP = _____ feet				
Maximum Pumping Rate of Well (Q) Q = _____ gallons/minute				
Length of screened interval (H) H = _____ feet				
$[(DUP - DTW) / (Q/H)] =$				
(up to 10 points maximum) choose one				
1. < 5	0			
2. 5 to 10	5			
3. > 10	10			

## California Drinking Water Source Assessment and Protection Program

## Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name: \_\_\_\_\_

PARAMETER	POINTS	
	Unconfined	Confined
<b>F. HYDRAULIC HEAD (Confined Aquifer)</b> What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) (up to 20 points maximum) choose one		
1. head in confined aquifer is higher than head in unconfined aquifer <u>under all conditions</u>		20
2. head in confined aquifer is higher than head in unconfined aquifer <u>under static conditions</u>		10
3. head in confined aquifer is lower than or same as head in unconfined aquifer		0
4. unknown		0
<b>G. WELL CONSTRUCTION (All Aquifers)</b>		
1. Sanitary Seal (Annular Seal) Depth = _____ feet (up to 10 points maximum) choose one		
a. None or less than 20 feet deep	0	0
b. 20 to 50 ft deep	6	10
c. 50 ft or greater	10	10
2. Surface seal (concrete cap) (up to 4 points maximum) choose one		
a. Not present or improperly constructed	0	0
b. Watertight, slopes away from well, at least 2' laterally in all directions	4	4
3. Flooding potential at well site (up to 1 point maximum) choose one		
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0	0
b. Not subject to flooding	1	1
4. Security at well site (up to 5 points maximum) choose one		
a. Not secure	0	0
b. Secure (i.e. housing, fencing, etc.)	5	5
Maximum Points Possible	80	100
<b>POINT TOTAL FOR THIS SOURCE</b>		

## Physical Barrier Effectiveness SCORE INTERPRETATION

<u>Point Total</u>	<u>Effectiveness</u>
____ 0 to 35 =	Low (includes all sources in Fractured Rock)
____ 36 to 70 =	Moderate
____ 71 to 100 =	High

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 1 9 6

D-042274.196



*California Drinking Water Source Assessment and Protection Program*

# WELL DATA SHEET

System Name: \_\_\_\_\_ System Number: \_\_\_\_\_

Source of Information: \_\_\_\_\_

Collected by: \_\_\_\_\_ Date: \_\_\_\_\_

*Complete as much information as possible. Leave blank if information is not available, use N.A. if not applicable.*

*\* Indicates items required for Source Water Assessment*

* Well Number or Name	_____
* DHS Source Identification Number (PS Code)	_____
State Well Number	_____
Date drilled	_____
Well Status (Active, Standby, Inactive)	_____
Location (Address)	_____
* Neighborhood (Commercial/Industrial, Residential/Municipal, Agricultural/Rural, Other) (list all that apply)	_____
Distance to: Sewer Line or Sewage Disposal	_____
Distance to: Other Wells (Active)	_____
Distance to: Other Wells (Abandoned)	_____
Size of controlled area around well (square feet)	_____
* Type of access control to well site (i.e., fencing, building, etc)	_____
Site plan on file? (yes or no)	_____
DWR Ground Water Basin	_____
DWR Ground Water Sub-basin	_____
* Within 100 year flood plain? (yes or no)	_____
* Drainage away from well? (yes or no)	_____
Enclosure/Housing: Type	_____
Condition	_____
Pit depth (if any)	_____
Floor (material)	_____
Well Construction Drilling Method	_____
Depth of Bore Hole (feet below ground surface)	_____
Finished Well Depth (feet below ground surface)	_____
Casing Depth (feet below ground surface)	_____
Casing Diameter	_____
Casing Material	_____
Conductor casing depth (feet below ground surface)	_____
Conductor casing diameter	_____
Conductor casing material	_____
Additional casing depth (if applicable)	_____
Additional casing diameter (if applicable)	_____
Additional casing material (if applicable)	_____

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

D - 0 4 2 2 7 4 - 1 9 7

D-042274.197

## California Drinking Water Source Assessment and Protection Program

## WELL DATA SHEET (Page 2 of 2)

*Complete as much information as possible. Leave blank if information is not available, use N.A. if not applicable.*

*\* Indicates items required for Source Water Assessment*

* Depth to highest perforations (feet below ground surface)	
* Total length of screened interval	
* Sanitary sealed (Annular Seal) (yes or no)	
* Depth of Annular Seal (ft)	
* Surface Seal (Concrete slab) (yes or no)	
* Radius of concrete slab (ft)	
* Gravel pack: Depth to (feet below ground surface)	
* Total length of gravel pack (ft)	
* Aquifer Materials (ie, sands, silts, clays, gravel, rocks, fractured rock, or combination)	
* Confining layer (Impervious Strata) above aquifer? (yes, no or not sure)	
Thickness	
Depth to (feet below ground surface)	
Sanitary Seal terminate in impervious strata? (yes or no)	
* Water Levels (Current): Static (feet below ground surface)	
When pumping (feet below ground surface)	
Well Yield (gpm)	
Based On	
Date measured	
Production (gallons per year)	
Pump: Make	
Type	
* Capacity, gpm	
Depth to suction intake (feet below ground surface)	
Lubrication	
Power	
Auxiliary power (yes or no)	
Operation controlled by	
Pump to Waste capability (yes or no)	
Discharges to	
Frequency of Use (hours/year)	
Typical pumping duration (hours/day)	
Well log on file? (yes or no)	
Remarks and Defects (use additional sheets if necessary)	

## Appendix K

### Possible Contaminating Activities (PCA) Inventory Form

#### Ground Water Source

Public water system and ID No.: \_\_\_\_\_

Name of drinking water source and ID No. \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by: \_\_\_\_\_

Ground water basin/aquifer name (if applicable) : \_\_\_\_\_

Indicate PCAs pertinent to the drinking water source, its protection area and zones, from the following tables, as applicable:

Commercial/Industrial (Table K-1) \_\_\_\_\_

Residential/Municipal (Table K-2) \_\_\_\_\_

Agricultural/Rural (Table K-3) \_\_\_\_\_

Other (required for all) (Table K-4) \_\_\_\_\_

Is this for a ground water recharge area? YES/NO \_\_\_\_\_ (If YES, also use Appendix D, Tables D-1 through D-4, as appropriate)

Attach map of Drinking Water Source with Zones A, B5 and B10 indicated, and buffer zones (if defined).

Proceed to appropriate checklist or checklists. Place a mark in the appropriate boxes.

Example:

		X

Risk Ranking of PCAs (see Tables 7-2, 7-3, 7-4 and 7-5 for separate category lists), where VH = Very High Risk, H = High Risk, M = Moderate Risk, L = Low Risk

California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 2 0 0

## California Drinking Water Source Assessment and Protection Program

PCA Checklist Table K-1, page 1 of 2 COMMERCIAL/INDUSTRIAL						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Automobile-related activities						
Body shops (H)						
Car washes (M)						
Gas stations (VH)						
Repair shops (H)						
Boat services/repair/refinishing (H)						
Chemical/petroleum processing/storage (VH)						
Chemical/petroleum pipelines (H)						
Dry cleaners (VH)						
Electrical/electronic manufacturing (H)						
Fleet/truck/bus terminals (H)						
Furniture repair/manufacturing (H)						
Home manufacturing (H)						
Junk/scrap/salvage yards (H)						
Machine shops (H)						
Metal plating/finishing/fabricating (VH)						
Photo processing/printing (H)						
Plastics/synthetics producers (VH)						
Research laboratories (H)						
Wood preserving/treating (H)						

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table K-1, page 2 of 2 COMMERCIAL/INDUSTRIAL						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Wood/pulp/paper processing and mills (H)						
Sewer lines (H, if in Zone A, otherwise L)						
Parking lots/malls (>50 spaces) (M)						
Cement/concrete plants (M)						
Food processing (M)						
Funeral services/graveyards (M)						
Hardware/lumber/parts stores (M)						
Appliance/Electronic Repair (L)						
Office buildings/complexes (L)						
Rental Yards (L)						
RV/mini storage (L)						
Other (list)						

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 2 0 2

D-042274.202

## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table K-2, page 1 of 2						
RESIDENTIAL/MUNICIPAL						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Airports - Maintenance/fueling areas (VH)						
Landfills/dumps (VH)						
Railroad yards/maintenance/fueling areas (H)						
Septic systems - high density (>1/acre) (VH if in Zone A, otherwise M)						
Sewer lines (H, if in Zone A, otherwise L)						
Utility stations - maintenance areas (H)						
Wastewater treatment plants (VH in Zone A, otherwise H)						
Drinking water treatment plants (M)						
Golf courses (M)						
Housing - high density (>1 house/0.5 acres) (M)						
Motor pools (M)						
Parks (M)						
Waste transfer/recycling stations (M)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table K-2, page 2 of 2 RESIDENTIAL/MUNICIPAL						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Apartments and condominiums (L)						
Campgrounds (L)						
Fire stations (L)						
Schools (L)						
RV Parks (L)						
Other (list)						



## California Drinking Water Source Assessment and Protection Program

PCA Checklist Table K-3, page 1 of 2						
AGRICULTURAL/RURAL						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
<b>Confined Animal Feeding Operations (CAFOs)</b>						
Auction lots (>50 head/acre) (VH in Zone A, otherwise H)						
Beef cattle (>50 head/acre) (VH in Zone A, otherwise H)						
Chicken/turkeys (> 200/facility) (VH in Zone A, otherwise H)						
Dairy cattle (>50 head/acre) (VH in Zone A, otherwise H)						
Sheep (>50 head/acre) (VH in Zone A, otherwise H)						
Swine (> 50 head/acre) (VH in Zone A, otherwise H)						
Other animal facilities (VH in Zone A, otherwise H)						
Farm chemical distributor/ application service (H)						
Farm machinery repair (H)						
<b>Residential parcels, &gt; 1 acre</b>						
Machine shops (H)						
Septic systems (H in Zone A, otherwise L)						
Lagoons / liquid wastes (H)						
Pesticide/fertilizer/ petroleum storage & transfer areas (H)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

*California Drinking Water Source Assessment and Protection Program*

**PCA Checklist**  
**Table K-3, page 2 of 2**

<b>AGRICULTURAL/RURAL</b>						
<b>PCA (Risk Ranking)</b>	<b>No PCA in zones</b>	<b>PCA in Zone A</b>	<b>PCA in Zone B5?</b>	<b>PCA in Zone B10?</b>	<b>Unknown</b>	<b>Comments</b>
Agricultural/Irrigation wells (H)						
Crops, irrigated (Berries, hops, mint, orchards, sod, greenhouses, vineyards, nurseries, vegetable) (M)						
Fertilizer, Pesticide/Herbicide Application without Resource Management (M)						
Sewage sludge/biosolids application (M)						
Crops, nonirrigated (e.g., Christmas trees, grains, grass seeds, hay, pasture) (L)						
Fertilizer, Pesticide/Herbicide Application with Resource Management (L)						
Other (list)						

## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table K-4, page 1 of 3						
OTHER ACTIVITIES						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
NPDES permitted discharges (H)						
Underground Injection of Commercial/Industrial Discharges (VH)						
Historic gas stations (VH)						
Historic waste dumps/landfills (VH)						
Illegal activities/unauthorized dumping (H)						
Injection wells/ dry wells/ sumps (VH)						
Military installations (VH)						
Mining operations - Historic (VH)						
Mining operations - Active (VH)						
Mining - Sand/Gravel (H)						
Wells - Oil, Gas, Geothermal (H)						
Known Contaminant Plumes (H)						
Salt Water Intrusion (H)						
Recreational area—surface water source (H)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

D - 0 4 2 2 7 4 - 2 0 7

D-042274.207

## California Drinking Water Source Assessment and Protection Program

PCA Checklist						
Table K-4 , page 2 of 3						
OTHER ACTIVITIES						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Underground storage tanks						
Confirmed leaking tanks (VH)						
Decommissioned - inactive tanks (L)						
Non-regulated tanks (tanks smaller than regulatory limit) (H)						
Not yet upgraded or registered tanks (H)						
Upgraded and/or registered - active tanks (L)						
Above ground storage tanks (M)						
Wells – Water supply, monitoring, test holes (M)						
Construction/demolition staging areas (M)						
Contractor or government agency equipment storage yards (M)						
Managed forests (M)						
Transportation corridors						
Freeways/state highways (M)						
Railroads (M)						
Historic railroad right-of-ways (M)						
Road Right-of-ways (herbicide use areas) (M)						
Roads/ Streets (L)						

California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft

D - 0 4 2 2 7 4 - 2 0 8

D-042274.208

*California Drinking Water Source Assessment and Protection Program*

PCA Checklist Table K-4, page 3 of 3						
OTHER ACTIVITIES						
PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B5?	PCA in Zone B10?	Unknown	Comments
Hospitals (M)						
Storm Drain Discharge Points (M)						
Storm Water Detention Facilities (M)						
Artificial Recharge Projects						
Injection wells (potable water) (L)						
Injection wells (non-potable water) (M)						
Spreading Basins (potable water) (L)						
Spreading Basins (non-potable water) (M)						
Medical/dental offices/clinics (L)						
Veterinary offices/clinics (L)						
Surface water - streams/lakes/rivers (L)						
Other (list)						

*California Department of Health Services  
 Division of Drinking Water and Environmental Management  
 August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 2 1 0

*California Drinking Water Source Assessment and Protection Program*

## Appendix L

### Possible Contaminating Activity Evaluation— Ground Water Source

(Note: This form is OPTIONAL. It should be completed for each PCA if a modification of the risk ranking of a PCA is desired)

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

#### PCA/Potential Contaminant Information

1. Type of Activity (from the PCA contaminant inventory checklist):

NOTE: The HIGH risk ranking for Abandoned or Improperly Destroyed Wells cannot be modified.

2. Type of potential contaminant associated with this activity (Refer Tables 7-2):

- a. Microbiological
- b. Chemical
- c. Both or Other

3. Potential Risk (from PCA contaminant inventory checklist):

- a. Low
- b. Medium
- c. High
- d. Very High

4. Location:

- a. Zone A
- b. Zone B5
- c. Zone B10

5. Spatial Area occupied by activity as percentage of Zone:

- a. Small (<5% of area)
- b. Moderate (5% to 25% of area)
- c. High (>25% of area)
- d. Unknown

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

*California Drinking Water Source Assessment and Protection Program*

6. Volume of potential contaminant (*not applicable for microbiological contaminants*):

If the maximum quantity of potential contaminant stored at the facility were discharged into the quantity of water produced by the drinking water supply in a day would the concentration be:

- a. Small (less than one part per billion)
- b. Moderate (between one part per thousand and one part per billion)
- c. High (more than one part per thousand)
- d. Unknown

7. Magnitude of potential acute or chronic health effects associated with the contaminant:

- a. Low
- b. High
- c. Unknown

8. Likelihood of potential contaminant to migrate to drinking water supply:

- a. Low
- b. High
- c. Unknown

9. Has the potential contaminant been detected in the drinking water supply or near-by monitoring wells?

- a. Yes
- b. No
- c. Unknown

10. Compliance of facility (demonstrated performance to keep potential contaminant from being discharged)

- a. Good
- b. Poor
- c. Unknown



*California Drinking Water Source Assessment and Protection Program*

**Determination of revised risk ranking for PCAs**

**Microbiological Contamination**

NOTE: In fractured rock aquifers, microbiological PCAs are always high risk, regardless of the zone, and cannot be modified.

If the PCA is categorized as **2a or 2c**, the risk ranking would be LOW if the PCA meets all of the parameters in the table below for **Low**. The risk ranking would be HIGH if the PCA meets all of the parameters in the table for **High**. Otherwise the risk ranking is MODERATE.

**Microbiological Contamination  
PCA Risk Ranking**

Parameter	Low	High
3	a or b	c or d
4	b or c	a
5	a	c or d
7	a	b or c
8	a	b or c
9	b	a or c
10	a	b or c

**Chemical Contamination**

If the PCA is categorized as **2b or 2c**, the risk ranking would be LOW if the PCA meets all of the parameters in the table below for **Low**. The risk ranking would be HIGH if the PCA meets all of the parameters in the table for **High**. Otherwise the risk ranking is MODERATE.

**Chemical Contamination  
PCA Risk Ranking**

Parameter	Low	High
3	a or b	c or d
4	c	a or b or c
5	a	c or d
6	a	c or d
7	a	b or c
8	a	b or c
9	b	a or c
10	a	b or c

*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 2 1 4

D-042274.214

## Appendix M

### Vulnerability Analysis Procedures – Ground Water Source

The Vulnerability analysis incorporates the Possible Contaminating Activities (PCAs) identified in the inventory, their respective Risk Rankings, the Zone and the Physical Barrier Effectiveness determination. These factors are used to determine the PCAs to which the drinking water source is most vulnerable.

Public water system \_\_\_\_\_ Identification number \_\_\_\_\_

Name of source \_\_\_\_\_ Identification number \_\_\_\_\_

Assessment date: \_\_\_\_\_ Assessment conducted by \_\_\_\_\_

Vulnerability analysis steps:

1. For each PCA identified as existing in the protection area, or unknown, determine number of points for that PCA. (If the risk ranking for a PCA has been modified, Appendix E should be attached). *(For example, Very High (VH) risk activities are 7 points.)*
2. For each PCA determine which zone in which it occurs. Add the points associated with that zone. If the PCA exists within more than one zone, repeat the process for each zone. *(For example, if the PCA exists in Zone A add 5 points. For a VH risk PCA in Zone A, the PCA + Zone points = 7 + 5 = 12 points.)*
3. For each Drinking Water Source determine the Physical Barrier Effectiveness (PBE) (from Appendix C). Add the points associated with that PBE. *(For example, if the PBE is Low add 5 points. For a VH risk PCA in Zone A, the Vulnerability Points = PCA points + Zone points + PBE points = 7 + 5 + 5 = 17 points.)*
4. Prioritize all PCAs by the Vulnerability Points, from the most points to the least. A sample form is shown below.
5. Drinking Water Source is vulnerable to all PCAs with Vulnerability Points **8** or greater. Refer to the Vulnerability Matrix below.
6. **In addition, the Drinking Water Source is vulnerable to all PCAs associated with a contaminant detected in the water source, regardless of Vulnerability Points.**

*California Drinking Water Source Assessment and Protection Program*

**Vulnerability Matrix for GROUND WATER SOURCES**

The cutoff point for vulnerability is 8. The drinking water source is considered Vulnerable to all PCAs with Vulnerability Score greater than or equal to 8 (shaded boxes).

PCA points	Zone points	PCA + Zone points	PBE Points			Vulnerability Score PCA + Zone + PBE points		
Risk Ranking	A, B5, B10		Low	Med	High	PBE Low	PBE Med	PBE High
VH (7)	A (5)	12	5	3	1	17	15	13
VH (7)	B5 (3)	10	5	3	1	15	13	11
VH (7)	B10 (1)	8	5	3	1	13	11	9
VH (7)	Unknown (0) *	7	5	3	1	12	10	8
H (5)	A (5)	10	5	3	1	15	13	11
H (5)	B5 (3)	8	5	3	1	13	11	9
H (5)	B10 (1)	6	5	3	1	11	9	7
H (5)	Unknown (0) *	5	5	3	1	10	8	6
M (3)	A (5)	8	5	3	1	13	11	9
M (3)	B5 (3)	6	5	3	1	11	9	7
M (3)	B10 (1)	4	5	3	1	9	7	5
M (3)	Unknown (0) *	3	5	3	1	8	6	4
L (1)	A (5)	6	5	3	1	11	9	7
L (1)	B5 (3)	4	5	3	1	9	7	5
L (1)	B10 (1)	2	5	3	1	7	5	1
L (1)	Unknown (0) *	1	5	3	1	6	4	2

\* Source is considered vulnerable to PCAs that are Unknown, if the Vulnerability points are 8 or higher. Therefore, a source is vulnerable to all Very High risk PCAs if it is unknown whether the PCAs exist.



*California Drinking Water Source Assessment and Protection Program*

page intentionally blank

*California Department of Health Services  
Division of Drinking Water and Environmental Management  
August 1998 Final Review Draft*

D - 0 4 2 2 7 4 - 2 1 8

D-042274.218

## Appendix N

### Checklist for Drinking Water Source Assessment – Ground Water Source

The following information should be contained in the drinking water source assessment report.

If another report that is the functional equivalent to the drinking water assessment (e.g., parts of an AB 3030 evaluation for a groundwater basin) is included in this assessment, the part of that report that fulfills the requirements of the source water assessment should be clearly indicated.

- \_\_\_\_\_ Source name, system name, and source and system identification numbers
- \_\_\_\_\_ Date of assessment and name of person and organization conducting the assessment
- \_\_\_\_\_ Drinking water source location and accuracy of method used (Appendix H)
- \_\_\_\_\_ Identification of delineated zones (Appendix I)
- \_\_\_\_\_ Drinking water Physical Barrier Effectiveness Checklist (Appendix J)
- \_\_\_\_\_ Possible contaminating activities (PCA) inventory forms and checklists (Appendix K).
- \_\_\_\_\_ PCA evaluation procedures (optional) (Appendix L)
- \_\_\_\_\_ Vulnerability analysis (Appendix M)
- \_\_\_\_\_ Assessment map with source location, protection area including zones, the recharge area and its watershed, and high and moderate vulnerability PCAs in zones.
- \_\_\_\_\_ Means of Public Availability of Report (indicate those that will be used)
  - \_\_\_\_\_ Notice in the annual water quality/consumer confidence report\* (required)
  - \_\_\_\_\_ Copy in DHS district office (required)
  - \_\_\_\_\_ Copy in public water supply office (recommended)
  - \_\_\_\_\_ Copy in public library/libraries
  - \_\_\_\_\_ Internet (indicate Internet address: \_\_\_\_\_)
  - \_\_\_\_\_ Other (describe)

\*The annual report should indicate where customers can review the assessments.